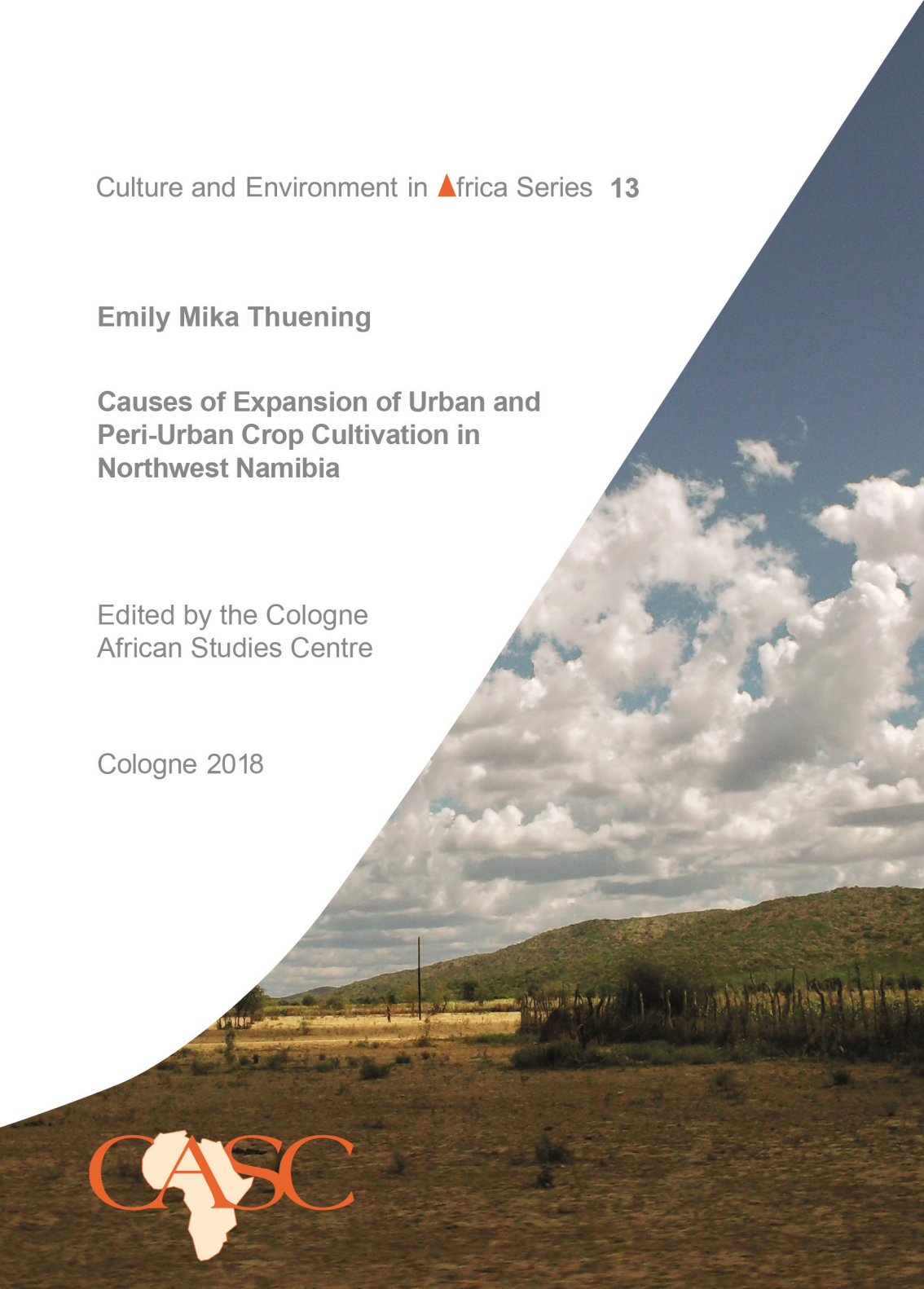
Culture and Environment in Africa Series 13

Emily Mika Thuening

Causes of Expansion of Urban and Peri-Urban Crop Cultivation in Northwest Namibia

Edited by the Cologne African Studies Centre

Cologne 2018



Emily Mika Thuening

Causes of Expansion of Urban and Peri-Urban Crop Cultivation in Northwest Namibia

CULTURE AND ENVIRONMENT IN AFRICA SERIES

Edited by the Cologne Africa Studies Centre

Issue 13

2018

Cover photo: N.S. Ibo

Preface

Urban and peri-urban gardening have gained in significance and academic attendance. Africa's cities are rapidly growing since the 1990s. Such growing urban populations need to be fed. As many urban dwellers are poor such food needs to be cheap and home-produced; but also the rising urban middle class has its food requirements and fresh relishes and vegetables are needed in increasing quantities. Hence, gardening in urban centres or at the margins of them becomes a worthwhile economic enterprise. Even small towns, like the north-western Namibian town of Opuwo, which has (only) some 7000 to 8000 inhabitants, witnesses such processes: agricultural lands close by the urban settlement get more intensively used and produce for the diverse demands of urban dwellers. This process of peri-urban agricultural intensification and expansion happened despite a few large super markets opening their businesses in Opuwo.

Mika Thuening collected data on peri-urban gardening for six weeks in spring 2016 in the context of a field practical run by the Institute for Social and Cultural Anthropology. She surveyed the urban markets (and supermarkets) and listed the prices and origins of food items on these markets. Then she did extensive interviews with local farmers on their motivation to farm and on practices of farming. Thuening identifies two groups of farmers: enterprising farmers workings at the margins of town who expressly say that they want to sell produce; other farmers did not name the sale of produce as a primary goal of production and rather gave household needs and household subsistence as their key motivation. They also produced maize to exchange the harvest (or part of it) for goats, i.e. expanding their small stock herds with the results of their work. Thuening succeeds in making different motivations transparent and gives a lively idea of varying motivation for farming and – combining interview data with remote sensing data – in showing the rapid expansion of peri-urban agriculture.

Abstract

This study focuses on one small but rapidly urbanizing city in arid northwest Namibia, where urban and peri-urban crop cultivation has been expanding in recent decades, yet the reasons behind this development are unclear. This thesis aims to identify the factors that are driving this change through three analytical lenses: demographic, socio-economic, and environmental. To achieve this, an understanding of the local food system was established both from the consumption and production side. A market survey was conducted, and farmer and agency interviews were carried out during a six-week research period on site in Opuwo, Namibia. The main drivers for crop expansion that emerged from this study include: environmental stressors, population pressure and urban migration; economic savings and dietary supplement; and supporting the informal social safety net. This paper discusses how these closely interconnected and complex factors work to influence the growth of cultivation in this water scarce landscape.

Key Words: urban and peri-urban agriculture, Namibia, crop cultivation, UPA expansion, environmental stressors, demographic pressure, urban migration

Acknowledgements

I owe deep gratitude to many people who made this work possible, including:

All the folks interviewed in Opuwo. Many thanks to the farmers and to the teams at ministries and NGOs, for their openness and patience to take the time to explain things to a stranger from afar in such detail. I was lucky to have Sacky as an invaluable team member in the field, spurring the project on and contributing new perspectives.

Michael Bollig and the Department of Anthropology at the University of Cologne for the opportunity to explore the topic of urban and peri-urban agriculture in Namibia, and for providing financial support for the field work.

Infinite gratitude to both Anna and Lea for being sounding boards for my musings, unveiling connections which were hiding in plain sight, and of course, hours of proofreading. A thousand thanks to Yew Jin and Ella for their assistance and patience with map creation. To Benny and Sara for being eternal springs of optimism and encouragement.

Niko for his partnership and support over the years: making delectable provisions for my seemingly endless hours of writing in the library, providing comfort on tough days, and sharing the extraordinary experience of Namibia.

And of course, Bernie and Jenna for instilling in me the value of investing myself into the life-long journey of education and the joyous pursuit of knowledge. Here's to more 'Golden Years adventures'!

Table of Contents

List of Abbreviations

CAN	Conservation Agriculture Namibia
FAO	Food and Agriculture Organization of the United Nations
GHG	Greenhouse Gas
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare
MoAWF	Ministry of Agriculture, Water and Forestry
MoLR	Ministry of Land Reform
NSA	Namibia Statistics Agency
N$	Namibian Dollar
NGO	Non-Governmental Organization
UN DESA	United Nations Department of Economic and Social Affairs
UPA	Urban and Peri-urban Agriculture

List of Figures and Tables

Chapter One: Introduction

1.1 Global Challenges

Humans of the 21st century are living in what is arguably the most precarious and uncertain of times. Earth's climate system is changing at rates unseen in recorded history. Concentrations of greenhouse gases (GHG), specifically carbon dioxide, methane, and nitrous oxide, in the atmosphere today are at magnitudes unparallelled in the last 800,000 years (IPCC, 2014, p.4). These soaring levels have lead to ever-increasing atmospheric and oceanic temperatures, diminishing global snow and ice cover, and surging sea levels, consequently endangering life on this planet. Scientific consensus identifies anthropogenic emissions of GHG as the root cause of this crisis, beginning from the dawn of the industrial revolution, a turn in human history which triggered a burgeoning economy and booming population (IPCC, 2014, p.4), and which has in effect placed a massive burden on Earth's resources.

One of the most resource demanding human undertakings, as well as one of the greatest sources of GHG emissions, is that of food production. The food system contributes significantly to human induced GHG emissions at all stages of the food chain. Direct emissions arise through cultivated soils and livestock, which emit large amounts of methane and nitrous oxides. Indirect emissions originate from fossil fuel use in farm operations, production and use of agrochemicals, post-production activities such as packaging, transportation and refrigeration, and finally conversion of forests to crop or pasture land, all of which emit carbon dioxide (Garnett, 2011; Vermeulen, Campbell, & Ingram, 2012). Factoring in both direct and indirect emissions, agriculture contributes 17 – 32% of total anthropogenic GHG emissions globally (Bellarby, Foereid, Hastings, & Smith, 2008, p.5).

In terms of resource consumption, the food chain uses water, land, and fuel at unsustainable rates. For example, agricultural production contributes 92% to the global annual water footprint (Hoekstra & Mekonnen, 2012, p.3232). Cropping, pastureland, and agro-forestry activities have jointly overrun an estimated 40% – 50% of the planet's terrestrial surface, consequently transforming approximately 6 million square km of forests and woodlands, and 4.7 million square km of grasslands into agricultural land since the year 1850 (Foley et al., 2005, p.560; IPCC, 2007; Lambin et al., 2001, p.262).

This continual seizure and alteration of land for agricultural purposes comes at a cost to ecosystems and biodiversity. Habitat fragmentation and destruction, an inescapable byproduct of agricultural sprawl, is precipitating mass species extinction (Pimm & Raven, 2000). Desertification and dryland degradation is in large part fueled by the expansion of grazing and cropping activities (Geist & Lambin, 2004). Poor farming methods, which have lead to over-

exploitation and degradation of soils and freshwater sources, are jeopardizing the ability of natural systems to maintain and regulate themselves, let alone to support food production for future generations (Foley et al., 2005).

The demand for resources and emissions of GHG are unlikely to abate in coming years considering that human population levels have skyrocketted in the past century, adding one billion people to the planet in the past 12 years alone, bringing the global population to 7.6 billion in mid-2017, and on track to add another one billion in the next 13 years (UN DESA, 2017, p.1-2). Remarkably, these additional billions of people will not be equally distributed across the land, but almost completely concentrated in cities, while rural populations will start to dwinlde in upcoming decades (UN DESA, 2007). A demographic milestone was hit in mid-2008 when the global urban population surpassed rural populations (Satterthwaite, McGranahan, & Tacoli, 2010, p.2809).

While cities bring positive aspects and opportunities to its dwellers, urbanization also presents several challenges, including pollution, poor sanitation, rising poverty, as well as food and nutritional vulnerability (de Zeeuw & Dubbeling, 2009). For both environmental survival and socio-economic justice, cities must adopt strategies that conserve and protect their natural resource bases of soil and water, ecosystem services, and production of food (Maheshwari & Bristow, 2016).

With an ever expanding population, dwindling natural resources, and the warming climate, humans are hurling down a shaky track into an unforseeable future. Commitments of Herculean proportions to intervene in the status quo must be made in order to assure functioning natural ecosystems for future generations.

1.2 Urban and Peri-Urban Agriculture as a Solution

In light of agriculture's weighty impacts on Earth's natural systems, one potential tool to temper this unpredictable future could be laying in the backyard of each urban and sub-urban citizen of the world. Urban and peri-urban agriculture (UPA) refers to the cultivation of crops, and less commonly livestock, in and around cities, and may encompass the processing, marketing and delivery of food products (Obudho & Foeken, 1999; van Veenhuizen, 2006, p.2). Urban farms can range from small subsistence-level family-run gardens, to large commercial cropping ventures (Vermeiren, Adiyia, Loopmans, Tumwine, & Van Rompaey, 2013). As of 2013, urban farms produced approximately 15% of the world's food (Gerster-Bentaya, 2013, p.723).

Urban and peri-urban farming offers a multi-faceted approach to various environmental burdens present in today's global food chain. Local production and consumption provide a unique opportunity to curb a food item's carbon foot print. For example, transportation is a

significant greenhouse gas emiting section of the food chain, as well as storage and packing operations (Sim, Barry, Clift, & Cowell, 2007). Local farming shortens the distance food travels from field to table, and can potentially minimize storage time and packaging materials. Further, due to land area restrictions in city spaces, UPA is generally limited to small and medium scales, entailing the use of farming methods which rely less on fossil fuel powered heavy machinery, as well as implementation of more targeted agrochemical use.

Beyond reducing negative environmental practices, urban and peri-urban farming supports positive environmental effects. Agricultural activities create green spaces of expanded and varied vegetation cover in the city, which in turn supports local ecosystems, improving air and water quality, as well as sustaining pollinators and other biodiversity (Lin, Philpott, & Jha, 2015). Socio-economic benefits span from livelihood diversification, food security, income generation, job creation, community development, nutrition and health improvement, and beautified urban spaces (Gerster-Bentaya, 2013). While the positive impacts of UPA are well documented, less attention has been placed on the reasons behind the growth of UPA.

1.3 Scope and Structure of this Thesis

This thesis focuses on one small but rapidly urbanizing city in arid northwest Namibia called Opuwo, where urban and peri-urban crop cultivation has been expanding in recent decades, yet the reasons for this development are unclear. By assessing this expansion and potential causes instigating its growth, this thesis intends to contribute to existing UPA knowledge by providing a case study on the drivers of UPA expansion in an urbanizing small city in Africa.

The aim of this study is to answer the question 'What factors (demographic, socio-economic, and environmental) have influenced the expansion of urban and peri-urban crop cultivation in Opuwo in the past three decades?'.

To achieve this, a foundational understanding of the food chain in Opuwo was established by conducting six-weeks of field work, through which two minor research objectives were addressed:

1. Establish a baseline understanding of food consumption in Opuwo.

   This objective includes exploration of the market landscape, the consumption patterns of local residents, the commodities available at market, and the origins of goods.

2. Evaluate local UPA production around Opuwo.

   This aim focuses on assessing agro-economic activities, such as cultivation practices, output, crop diversity, and challenges that farmers face.

Finally, this knowledge was brought together to draw out various conclusions behind potential causes behind the expansion of crop cultivation around Opuwo, analyzing the topic through three lenses: demographic, socio-economic, and environmental.

This thesis is structured into six chapters. This introductionary chapter outlines the topic and its significance in the global context and defines the study aims. Chapter two explores the landscape of existing knowledge on UPA in Africa and agriculture in Namibia. Chapter three frames the methodology used to conduct the research. Chapter four presents the results of the field work. Chapter five is the discussion section and aims to fulfill the research objectives and address the main research question. Chapter six provides concluding remarks.

Chapter Two: Literature Review

According to the UN Department of Economic and Social Affairs (UN DESA) (2017), 17% of the world's population were living on the continent of Africa in 2017 (p.4); between 2017 and 2050, over half of the world's people will be born in African countries (p.3). After 2050, Africa will be the single greatest contributor to global population numbers (UN DESA, 2017, p.4). With 56% of the population projected to be living in urban areas, African cities are set to become home to almost a quarter of the entire world's urban population (UN DESA, 2014). Considering the challenges that accompany population growth and urbanization, the continent will be in a unique position in the upcoming century.

The aim of this thesis is to assess expansion of UPA cropping in Namibia. As studies on UPA in Namibia are not widely available, this literature review brings together perspectives from UPA in other countries throughout Africa, as well as crop cultivation in Namibia. The first section looks at the role of UPA in the African context, creating a base understanding of what urban and peri-urban areas constitute, and then pulls case studies from around the continent. The second part of the literature review hones in on Namibia, outlining the agricultural profile of the country and wrapping up with case studies on cropping in Namibia.

2.1 Urban and Peri-Urban Agriculture

In recent decades, urban and peri-urban agriculture has risen in prominence in academic, policy, and development spheres as a potential economic, social, and environmental solution to some of the problems of urbanization.

The onward march of urbanization brings with it an associated peri-urbanization movement, where rural lifestyles and homogenous landscapes are gradually overtaken by a more heterogeneous populous, increasingly complex socio-economic structures, and varied land uses (Brook & Davila, 2000). As the city expands, the peri-urban belt shifts with it, demarcated at a range of 10 – 25 km from the concentrated urban center (Cobbinah & Amoako, 2012, p.315). Peri-urban spaces can be generally defined as areas of transition between urban and rural zones, with ever-changing penetrable boundaries (Maheshwari & Bristow, 2016, p.263).

At this rural-urban interface, peri-urban agriculture can take place either as a remnant of a rural past or as an expansion of urban-based agricultural activities. As of 2014, the global area of urban cropland was estimated to be approximately 67 million hectares (ha), or 5.9% of total global croplands; drawing a 20 km buffer around city centers to incorporate peri-urban spaces, cropped areas reach 456 million ha worldwide (Thebo, Drechsel, & Lambin, 2014, p.4-8).

Throughout the continent of Africa, urban and peri-urban farming is on the rise (Obudho & Foeken, 1999). Much of the literature on UPA in sub-Saharan Africa asserts that urban and peri-urban agriculture is employed as a coping mechanism against economic hardships such as declines in formal urban economies, few employment opportunities, dropping income levels and purchasing power, and increasing food prices (Castillo, 2003; Tacoli, 1998). The following section takes a jaunt through cities across the continent, sampling literature on urban and peri-urban farming throughout Africa to illustrate the existing knowledge landscape. Much literature exists on large-size cities, however the studies included here focus on smaller cities, which is relevant for this study's area of Opuwo.

2.1.1 Case Studies: Urban and Peri-Urban Agriculture across Africa

The review begins in East Africa, in two urban centers in Kenya where citizens are subject to high unemployment, poverty, and food insecurity. Omondi, Oluoch-Kosura and Jirström (2017) investigated the role of UPA in the local food system, finding that over half of the households surveyed produce food to meet at least a portion of their food demand. Investigating how the farmers use their yields, Omondi et al. uncovered that almost all farmers consume their produce, about one-third sell it to earn cash income, and 40% transfer food to family and friends (p.236). Survey respondents indicated that producing their own food is vital to their survival, allowing them to eat for five months from their own food stores, and thus relying less on purchased food. Compared to non-farming families, farming households were deemed not only more food secure, but also more nutritionally secure, as they have access to food varieties that may not be available at market.

Moving west across the continent, a recent study in two urbanizing mid-sized cities in Ghana similarly found UPA to be an important economic supplement and vital element of food security for poor urban households (Ayerakwa, 2017). Agricultural production meets nutritional needs both for home consumption, and for the community, as yields are commonly gifted to family members and friends. Additionally, sale of surplus food is an important contribution to household cash income. In these two cases, approximately 33% – 43% of a typical household's total cash income was raised through sales of agricultural produce (p.217).

Also investigating the relation between socio-economic status and UPA participation, Dossa, Buerkert and Schlecht (2011) surveyed three cities in Mali, Nigeria, and Burkina Faso. While much academic literature asserts that UPA is employed only by people with low economic or educational standing as a survival strategy, Dossa et al. found that, on the contrary, UPA is employed by all socio-economic classes. Poorer households are motivated by the potential to generate cash income and improve nutritional conditions, while middle and upper income

households anticipate saving money on food expenses and diversifying income sources. Furthermore, the activities engaged in differ between socio-economic groups. Crop cultivation is employed more commonly by lower income households, as it requires little capital investment and more labor, whereas wealthier families invest in livestock, generally as a commercial income generating activity. Dossa et al. found the greatest factor in UPA participation relates to household size. Large households are more likely to engage in UPA than small households, as they have more dependents to feed, and thus a higher risk of food insecurity.

A case in Cameroon explores the connection between macro-economic events and the practice of UPA, and also touches on environmental implications. Akey and Magloire (2012) explained how peri-urban agriculture intensified around the city of Yaounde in response to economic crisis in 1986 – 87, when prices of coffee and cocoa, the country's main export crops, crashed. Another shock hit in 1994 when the value of the Cameroonian Franc dropped by 50%. To soften these economic blows, urbanites turned to cultivating peri-urban areas around the city (p.146). While UPA provided economic relief, it took an ecological toll on the surrounding landscapes. Clearing fields around the city meant cutting the dense humid semi-deciduous forests, resulting in habitat destruction. The citizenry stated that endemic animal species have since disappeared, tree cover has been significantly reduced, and ecologically unique marsh lands have diminished. Finally, agricultural land which is cultivated year-round, has exhausted soil nutrients and led to erosion. So while UPA provided a financial boon to urban and peri-urban farmers, negative environmental effects were observed in just three decades.

Moving on to South Africa, Thornton (2008) presents case studies of two small towns which share some characteristics with the study area of this thesis. With populations of approximately 5,000 residents and 100,000 residents, and both administrative municipal seats, the sample towns are located in a semi-arid climate, where overgrazing has left soils fragile and eroded. Amidst rising poverty and unemployment, as well as an influx of migrant labor, the study investigated the importance of UPA for low-income households. Thornton found that households with formal sector employment do not participate significantly in UPA, whereas unemployed, grant-receiving households are the most active in UPA. However, it was also uncovered that UPA yields contribute little to a family's livelihood, as most families could not survive without social welfare grants to cover their basic needs. Besides low production, other factors which limit UPA's relevance were: lack of commercial market opportunities, insufficient support from governmental and non-governmental authorities, and finally a social stigma amongst youth which connects subsistence agriculture to historically racist systems. In conclusion, UPA activities were not instrumental in achieving food security for farmers in these sample cites, contradicting other studies on the subject. On a final note, considering that urban

poverty is most rampant in small towns, Thornton calls for academia to focus more UPA research on small cities.

The case studies included here presented examples of UPA in urbanizing cities from around the continent. All studies focused predominantly on socio-economic aspects of UPA, but arrived at different conclusions regarding its importance to households' food security and livelihoods. Many different factors influence the degree to which UPA is adopted and its impact on a household, including other employment opportunities, market access, macro-economic milieu, and social welfare support. From here, this literature review shifts the spotlight to Namibia, first illustrating the agricultural profile of Namibia, and then focusing in on case studies of small-scale cropping in Namibia.

2.2 Agriculture in Namibia

2.2.1 Demographic Profile

Namibia is no exception to population growth and rapid urbanization. Throughout the mid-20th century, the Namibian population has mushroomed more than five-fold, from 485,000 people in 1950 to 2,534,000 people in 2017 (UN DESA, 2017, p.26). The population is concentrated in the capital of Windhoek, as well as along the northern border with Angola (Pankurst, 1995, p.552). In coming years, Namibia's rural areas will be deserted in favor of urban life. By 2030, approximately 60% of Namibians will reside in urban areas (NSA, 2014c, p.4).

2.2.2 Agricultural Profile

Despite the fact that agriculture provides a mere 5% to the southwestern African nation's GDP (Humavindu & Stage, 2013, p.2), it is paramount to the majority of Namibians' livelihoods. Some 73.5% of the population participates in some way in farming (NSA, 2015a, p.14), and an estimated 70% of the population depends on agriculture for their livelihoods, either directly or indirectly (Horsthemke, 2009, p.33).

In terms of land use, approximately 78% of the country's land is allocated to agricultural activities (Mendelsohn, 2006, p.10). Most of this land is used for grazing, cattle in the north and goats and sheep in the south, with less than 10% dedicated to cropland (Government of Namibia, 2002, p.38). The main cereal crops grown are maize and millet, followed by smaller amounts of sorghum and wheat, as well as some fruits and vegetables. Most produce that is grown domestically is also consumed domestically, supplemented by imported cereals, fruits, and vegetables (NSA, 2015a). Namibia is a net food importer, 80% of which comes from South Africa (Froystad, Hoffmann, & Schade, 2009, p.2). Being pegged to the South African Rand, the Namibian dollar is subject to regional currency fluctuations, which in turn affects the value

of exports and the costs of imports. Trade is particularly significant during times of drought, as seen in 2015 and 2016. During these times, local food output drops due to decreased rainfall and crop failure, and market demand increases for staple crops, as does price (Shifiona, Dongyang, & Zhiguan, 2016). Food self-sufficiency fluctuates between 35 – 75% of total demand, depending on climate conditions (Froystad et al., 2009, p.3). This aggravates an already delicate situation where one third of the population is food insecure (United Nations Country Team-Namibia, 2013, p.57). The 2011 census reported 76% of households experienced food shortages that year (NSA, 2015a, p.12). With such shortages, an increasing number of people must depend on food assistance from the government and intergovernmental agencies.

Land Tenure and Dual Agricultures

Not all Namibian farmers are affected by climatic and global market fluctuations equally. How deeply a farmer is impacted by external shocks is reflective of his or her land ownership status. Colonial and apartheid policies institutionalized profoundly unequal land rights through a dual land tenure system (Pankhurst, 1995). This system is divided into "commercial" and "communal" land. Commercial land implies private ownership (predominantly by descendants of white colonial settlers), and production is capital intensive and geared towards export. Communal land is state property but managed by traditional rules. Land is generally used for labor intensive, low-technology, subsistence farming. Community authorities allocate crop parcels to individual households, whereas grazing land is shared and usually not fenced (Verlinden & Kruger, 2007). Land occupancy in the area of Opuwo falls under communal land. Around the time of independence, commercial landholders constituted less than 10% of the population, but owned over half of Namibia's agricultural land, while the remaining land supported 70% of Namibians (Falk et al., 2017, p.315; Pankhurst, 1995, p.553). The post–independence government established land reform policies attempting to redistribute and secure land rights, namely the Agricultural (Commercial) Land Reform Act of 1995 and the Communal Land Reform Act of 2002. Despite the development of such political and legal frameworks, very little has changed on this front in the past two and a half decades (Werner, 2015). Namibia still stands as one of the most economically unequal countries in the world (IOM, 2016; United Nations Country Team-Namibia, 2013).

Cattle Farmers

Historically, the majority of Namibian farmers have practiced nomadic pastoralism, moving herds of cattle between water sources seasonally on communally owned land. Livestock is still an important source of livelihood for many farmers today. For communal pastoralists, cattle are

considered a long-term investment strategy, serving as a “bank account” and acting as a family’s health, unemployment and retirement insurance (Falk, 2008, p.125-6) more than as a regular income source. This is in part due to farmers’ limited engagement in the formal market economy, for reasons ranging from policy barriers to marketing opportunities (Shiimi, Taljaard, & Jordaan, 2012), making it more profitable to retain cattle than to sell.

The situation, however, for cattle herders has become more strained in recent decades. Starting in the 1950s, the colonial government executed large-scale borehole drilling projects, opening up more grazing land and significantly changing the relationship of people and their cattle to the land (Bollig, 2013). With year-round availability of water, land that was once grazed a few months a year and left to regenerate in the off-season, was now stocked with larger numbers of cattle grazing for longer periods of time. This shift to intensive grazing practices proved instrumental in land degradation; where perennial grasses once blanketed the pastures, annual grasses took over (Bollig & Schulte, 1999).

Cultivation in Namibia

Although nomadic pastoralism has historically dominated Namibia’s agricultural landscape, the population is also actively engaged in crop cultivation, especially in northeastern areas that receive adequate rainfall which enable rain-fed cropping. Commercially, a small amount of land is utilized for cropping, such as the Grootfontein-Otavi-Tsumeb triangle and areas in the south, but this arable production contributes a meagre seven percent to gross commercial farm income nationally (Pankhurst, 1995, p.578). While communal cropping activities do not factor significantly into the formal economy, it is an important activity for much of the population. At the country level, 32.8% of Namibian households reported participating in crop farming, with 57% of rural households participating and 7.7% of urban households (NSA, 2013, p.69). Although the Food and Agriculture Organization (FAO) of the United Nations reported that community and group gardens in Namibia contribute approximately half of the food grown locally in urban areas (FAO, 2012, p.18), literature on UPA in Namibia is lacking. Therefore, the following section explores crop cultivation in communal areas in northern Namibia, drawing similarities to our study area.

2.2.3 Case Studies: Cropping in Namibia

As mentioned, agriculture in Namibia is commonly understood as a dual system. However Low, Akwenye and Kamwi (1999) went a step further to define a third branch in the agricultural structure across northern Namibia. Besides (large-scale) commercial farms and (peasant / semi-subsistence family) communal farms, Low et al. asserted that emerging commercial family farms should be taken into consideration. Commercial family farms carry high input

costs, receive substantial governmental support, and depend almost exclusively on their own household labor. An example of this farm type is the Etunda irrigation scheme, a governmental project set up in 1993 near Ruacana, approximately 100 km northwest of Opuwo. The project is split between a commercial production system and small-scale family farming. The family farmers came from various regions around northern Namibia and received 3 ha of irrigated land in the settlement project, as well as governmental support such as tractor services and financing. Commercial family farms differ from semi-subsistence family farms which require very low input costs, receive little to no governmental services, and source external labor only through community and kinship ties. Further, subsistence farmers' income is diversified between crop cultivation (primarily pearl millet in this case), livestock production, and non-farm income such as pension, remittances, outside employment, and crafts, as opposed to commercial family farmers whose primary economic activity is farming.

The situation of such commercial family farms was elaborated on in a 2010 report on small-scale irrigation farmers in a neighboring region, Omusati (Fiebiger et al., 2010). The report classifies 5 different "clusters" of farmers, ranging from micro-scale farmers who implement irrigation methods by bucket-watering on half-hectare plots, up to mechanized drip irrigation farming schemes on parcels up to 13 ha, as well as farmers who participate in the governmentally subsidized Green Scheme outgrower program in Etunda. Farmers in every cluster focus on producing fresh vegetables for the market to earn income, made possible by the presence of perennial water sources. While the smaller private family farmers face uphill challenges, such as lack of marketing infrastructure, transportation limitations, cost-restrictive inputs, lack of training, and competition, they manage to perform similarly well as compared to the Green Scheme farmers who receive substantial support. Growing market demand for fresh vegetables in the region could bode well for the future of local production in the area, however there are still great obstacles that must be overcome in order for this sector to fully integrate into the food retail chain and realize the economic potentials.

Zooming in on the northwest, Bollig (2006) provided a snapshot of small-scale agricultural activities of a group of Himba pastoralists along the ephemeral Omuhonga River and along the Kunene River, a perennial river on the northern border with Angola, in an area ranging 100 – 180 km northeast of Opuwo. Most households supplement their livelihoods with garden produce, utilizing the fertile alluvial soils of the flood plains on the banks of the river to grow maize and other foodstuffs. Gardens are of varying size, averaging 7,000 m^2. In the absence of exact yield data, estimations were drawn based on comparisons with a case study in Ethiopia, concluding that a family may produce approximately 500 – 600 kg of maize per year (p.277). Despite the fact that this amount falls short of annual nutritional requirements for a

large family, the supplemental harvest decreases the amount of maize meal which must be purchased from the market, and may prevent sales of livestock for maize meal in the dry season.

Focusing in on a single Himba community on the Omuhonga River, Welle and Franke (2006) investigated the growth of small-scale agriculture using Geographic Information Systems (GIS) to analyze land use change on a several kilometer stretch of river, comparing aerial images from 1996 and 2006. Remote sensing analysis concluded that garden cultivation has intensified along the main river, expanded to tributary rivers, and gardens have even appeared off of the course of the river. Welle and Franke identified a 92.6% increase in the number of gardens, as well as a 100 ha increase of cultivated land in the study area, and noted that the average size of individual gardens has decreased (p.161). This may be attributable to increasing population levels, a shift away from a pastoral nomadic culture towards adopting a permanent settler culture, and/or a livelihood diversification strategy.

The studies of cultivation in Namibia that have been included thus far bring to light the diversity of cropping employed throughout northern Namibia. While this final case from Wingate, Phinn, Kuhn, Bloemertz, and Dhanjal-Adams (2016) lies further east of our study area, it is included here as an example of exploring causes connected to agricultural expansion. Using remote sensing to track land cover change in northeast Namibia between 1975 – 2014, Wingate et al. detected a loss of woodland area and an associated increase in small-scale subsistence farming, as well as a marked increase in urban area. Much like Opuwo, the land is communally held and rain-fed cropping is clustered around ephemeral rivers. The hinterlands are used for cattle grazing and vegetation in the shrub lands are predominantly *Colophospermum mopane.* The most significant increases in agricultural land occurred closest to cities, rivers and roads, decreasing with distance from these landmarks (p.15). This expansion of subsistence farming is suspected to be an effect of population growth, improved transportation infrastructure allowing easier access to natural resources, and poor administrative management. It is predicted to be an unsustainable trend, due to soil depletion in such marginal areas.

2.3 Gaps in Literature

This literature review endeavored to bring together two areas of knowledge: UPA across Africa and crop cultivation in Namibia, thus providing a foundation on which to build the discussion of UPA cropping in Namibia.

The literature suggests that there are varying reasons behind participation in UPA in sub-Saharan Africa. Academic studies present opposing conclusions on the influence of socio-economic level on UPA participation, and its importance to improved food security. Most

literature addresses economic relationships, and only one touched on environmental impacts of UPA. Both Omondi et al. (2017, p.233) and Thornton (2008, p.247) called for more research on UPA in smaller cities, considering these communities often face rapid urbanization rates, high poverty rates, and could hold promise as future centers for urban farming.

In terms of literature on agriculture in Namibia, studies on pastoralism and livestock abound, while fewer studies have covered cultivation and none were found specifically on UPA. Still, a few case studies do describe small scale cultivation in the north and northwestern regions, which are helpful as base knowledge for this thesis.

No research found to date specifically explores urban and peri-urban crop cultivation in northwest Namibia. This thesis addresses this gap.

Chapter Three: Methodology

3.1 Study Area

This thesis focuses on the city of Opuwo, administrative capital of the Kunene region in northwestern Namibia. Opuwo is located approximately 700 km northwest from the capital Windhoek and about 90 km south of the Angolan border, and lies at the eastern edge of the Hoarusib Basin. Figure 1 outlines the greater context of the study area, displaying Namibian country borders, the capital city Windhoek, the borders of Kunene region, and the location of Opuwo city.

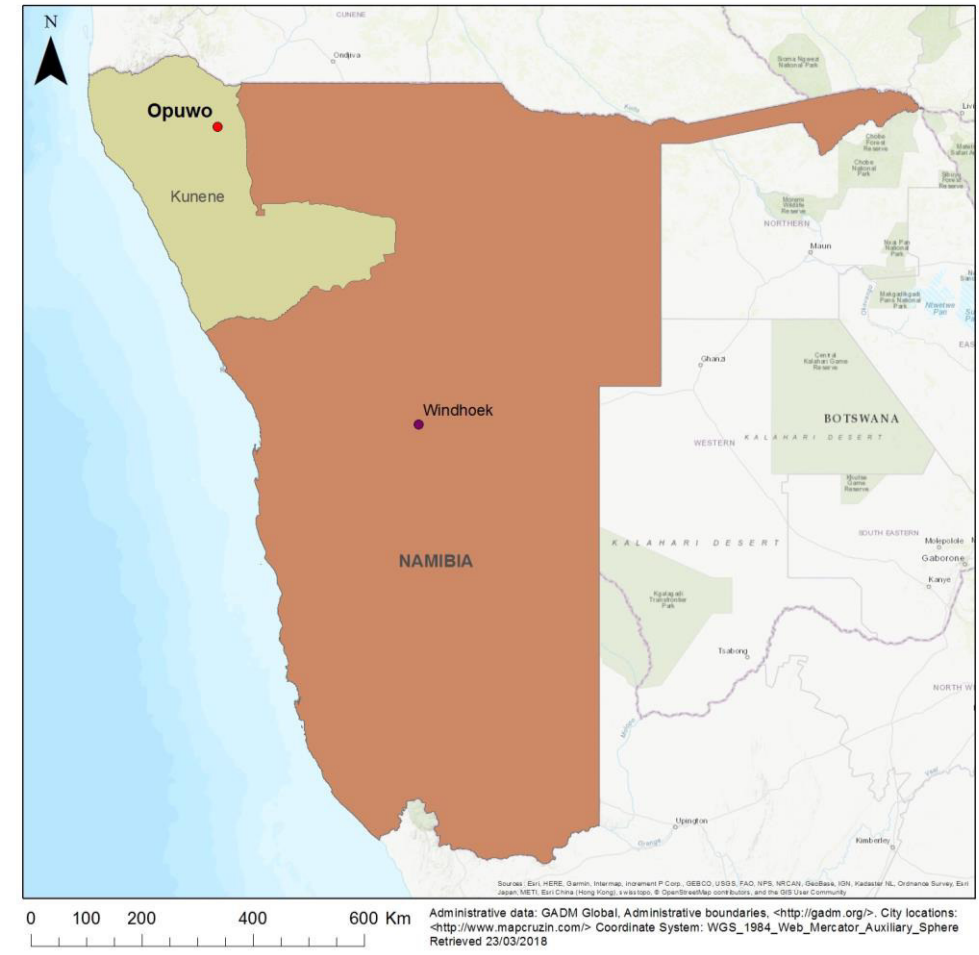


Figure 1. Contextual map of study area: Opuwo, Kunene, Namibia.
(Rendered by M. Thuening, March 2018)

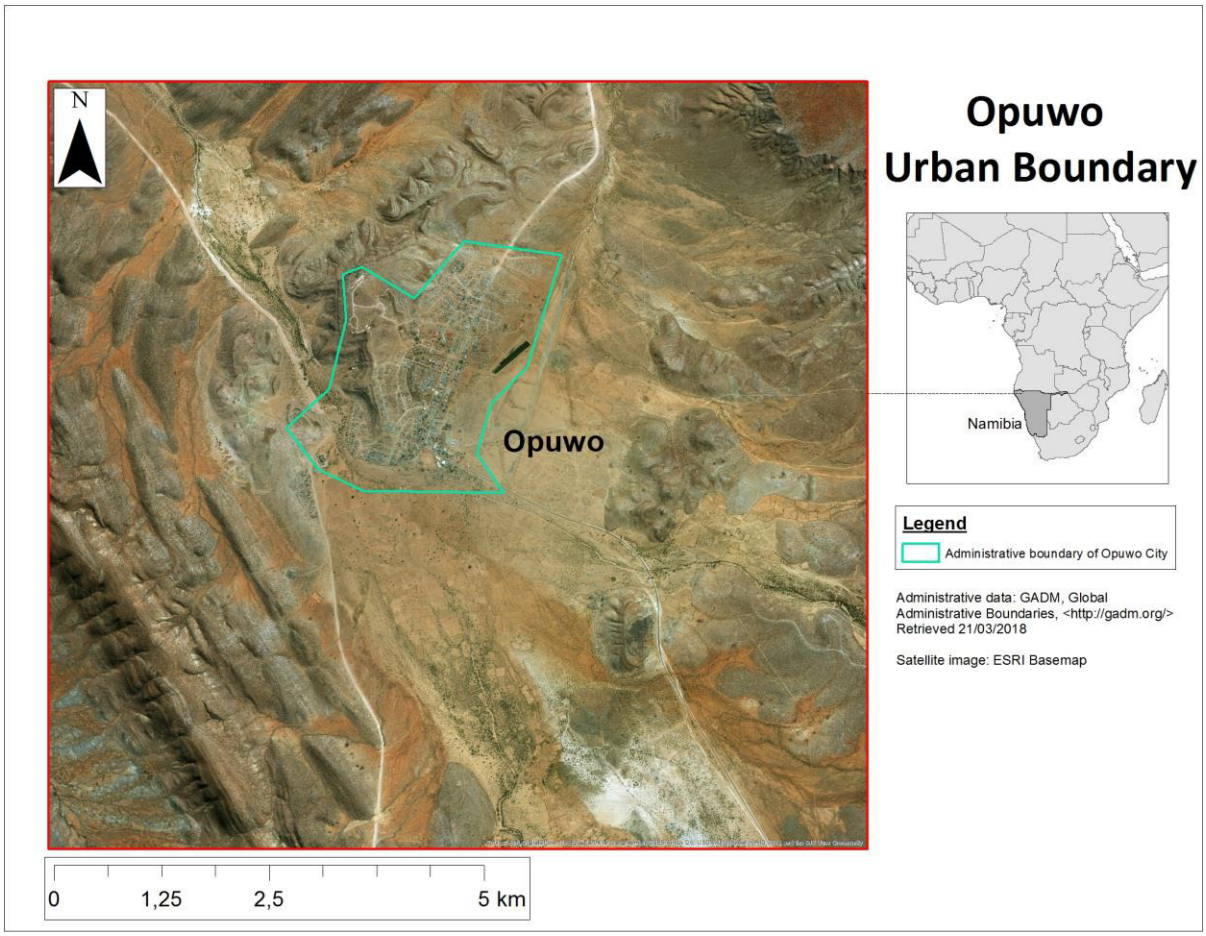


Figure 2. Opuwo urban area highlighted by official administrative boundary outline.
(Rendered by Y.J. Lee, March 2018)

An aerial image of Opuwo can be seen in Figure 2, with the official administrative boundary highlighted in green. Rainwater falling within this 15,100 km^2 area of the Kaokoveld collects and drains into the ephemeral Hoarusib River, a 300 km river flowing seasonally to the Atlantic Ocean (Jacobson, Jacobson, & Seely, 1995, p.125). This river catchment is dominated by mopane savannah vegetation and is home to various wildlife species. Namibia, being one of the sunniest countries in the world, receives an average of 300 days of sun per year. High evaporation rates, at an average of 3,000 mm per year, far exceed precipitation rates, creating the semi-arid climate of the Northwest (Jacobson et al., 1995, p.16). The wet season arrives in Opuwo around November, when the Inter-Tropical Convergence Zone moves south over the continent and brings with it rain. In April, the convergence zone begins its ascent north, taking the rains with it and leaving the land dry from approximately May to October. Average annual precipitation rates for Opuwo are 299 mm, however such rates are a poor predictor of rainfall for the year to come, considering the high variability of rainfall from year to year, and high prevalence of droughts (Bollig, 2006, p.112; Jacobson et al., 1995, p.13-16). On the western

coast for example, rainfall can vary as much as 100% from the mean. Climactic variability rates for Opuwo stand at 28% (Bollig, 2006, p.113).

Drought is recorded as a frequent and regularly occurring phenomenon in Namibia, with the 2012 / 2013 and 2014 / 2015 rainy seasons being some of the driest and most catastrophic in recent history, forcing many farmers to seek governmental food aid on account of the sparse or non-existent vegetation available for livestock fodder, as well as crop failure. The study region of Kunene is no stranger to these conditions, frequenting national and international news headlines as one of the most devastated areas.

The city of Opuwo is home to over 7,600 residents, the 13th largest city in Namibia by population (NSA, 2013, p.7). While a small city, Opuwo is exceptionally fast growing, with a 2.7% annual growth rate as of 2011 (NSA, 2014a, p.12). Between 2001 and 2011 the population increased 50.1% (NSA, 2013, p.39). Population growth was attributed to the presence of the South African military and its associated service industry throughout the 1980s, followed by an influx of refugees from the Angolan war in the 1990s. Major ethnic groups residing in and around Opuwo are the Otjiherero speaking Herero and Himba people groups, the Damara, Nama, and Zemba groups, as well as Angolan migrants (NSA, 2014a, p.102).

Every ten years since independence, the Namibia Statistics Agency (NSA) has conducted a nationwide census. The following data are derived from the 2011 census data for the Kunene region (NSA, 2014a), and the Kunene 4th Delimitation Report data (NSA, 2014b). The population of the Opuwo region is young, with a median age of 18 years old (NSA, 2014a, p.3). Average household size is 5.2 people (NSA, 2014a, p. vii). While the adult literacy rate (age 15+) in the rural areas of Opuwo constituency is low, at 47.5%, rates in the urban areas of Opuwo constituency is 74.0% (NSA, 2014b, p.20). Youth literacy rates (age 15-24) in urban centers of the region stands at 92.3% (NSA, 2014a, p.20), indicating the rising importance of educational opportunities in urban areas, one factor behind migration to urban areas. Unemployment hits urban residents harder than those in rural areas: 50% of urbanites are unemployed while only 28.5% of rural folks are unemployed (NSA, 2014a, p.28). Focusing on the urban areas of Opuwo, approximately 52% of residents earn their income through wages and salaries, or non-farming business (NSA, 2014b, p.38). Agricultural activities serve as the main source of income for 28% of the employed population (NSA, 2014b, p.38). Old-age pension, remittances, and various types of government grants support the remainder of urban residents. Over one third of the population is employed in the public sector, one third in the private sector, and 22% are subsistence farmers (NSA, 2014b, p.36).

While most inhabitants of Kunene have historically been engaged in cattle herding, recent decades have witnessed crop cultivation blossoming in and around the regional capital. About

half of the urban households that are engaged in agricultural activities cultivate crops (48%), and the other half raise livestock (42%), poultry, or participate in other activities (NSA, 2014b, p.41).

The development of cropping can be clearly observed from satellite images. Figures 3 – 5 illustrate the expansion of farms surrounding an ephemeral stream about nine kilometers south-southeast of Opuwo. Figures 3 and 4 are aerial images recorded in April 2008 and December 2016, respectively. Figure 5 highlights new farm units which were established within the eight-year period, discernable by the borders of fencing farmers erect when first establishing a new cropping area, which have been delineated in red and overlayed on the 2016 image. In less than a decade, the spread of cultivated land is clearly visible.

The choice of Opuwo for this study provides insight into the challenges and opportunities of a changing food system in the context of a rapidly urbanizing small city, home to a young and increasingly educated population, facing high unemployment rates. Further, it illuminates a historical transition of a pastoral-based society in an arid climate towards more sedentary crop cultivation.

Figure 3. Peri-urban crop cultivation 9 km SSE from Opuwo, 2008.
(Obtained from Google Earth Pro, image recorded 22/04/2008)

Figure 4. Peri-urban crop cultivation 9 km SSE from Opuwo, 2016.
(Obtained from Google Earth Pro, image recorded 31/12/2016)

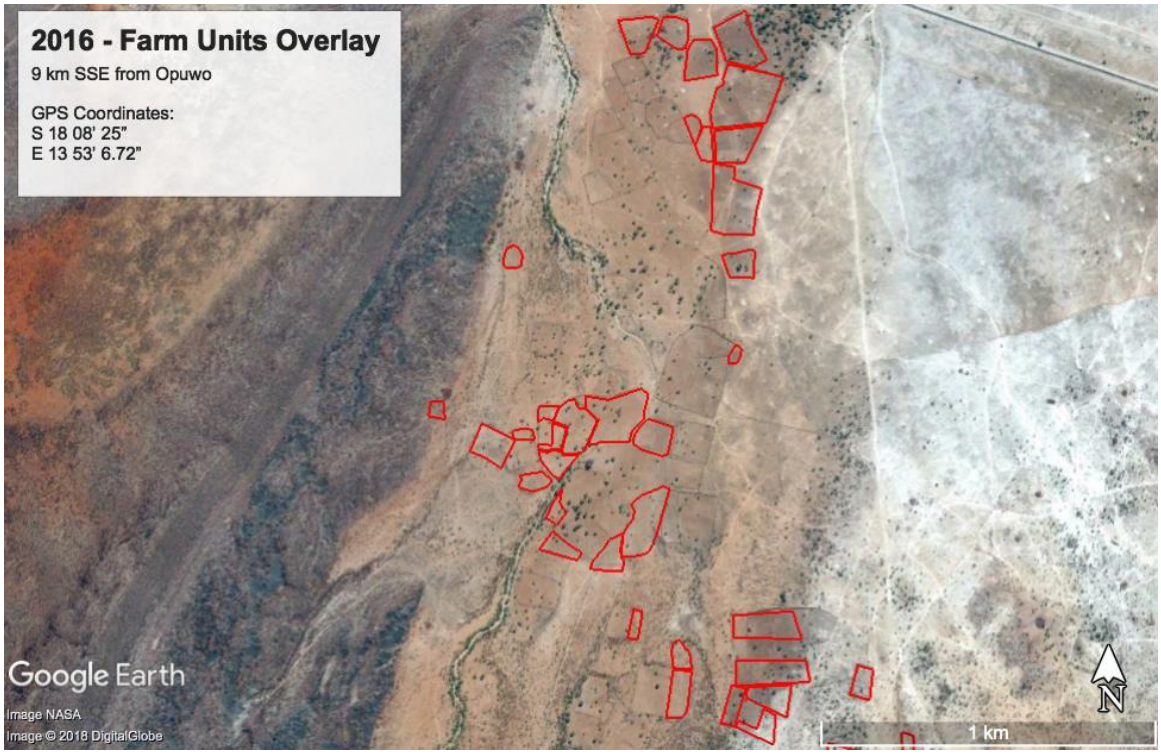


Figure 5. Farm unit development between 2008 – 2016.
(Obtained from Google Earth Pro, image recorded 31/12/2016. Farm unit overlay rendered by M. Thuening)

3.2 Conceptual Framework

Research was undertaken with a holistic and ecological approach in mind. Hybrid in nature, the ecological approach allows for the study of individual parts of a system, while simultaneously prioritizing the 'whole' organism (Sachs, 2010, p.30). This perspective acknowledges how each individual part of a system is related to one another as well as to the 'whole', and can be particularly useful in investigating cross-sectoral themes, such as UPA, which encompass environmental, economic, social, and demographic elements. A strength of this concept is that of inclusion, incorporating investigation of the natural biological environment with that of the non-living world (e.g. technology), along with the human world (e.g. culture, built environments). Further, it can be applied at varying scales, for example from global scales, down to countries, cities, households or individuals. As Sachs (2010) put it, ecosystems are "hailed as the keys to understanding order in the world" (p. 31). This holistic approach guided the definition of research objectives and the selection of methodological tools.

3.3 Description of Methods

Following the holistic approach, this study aimed to gain a complete picture of the entire food chain in Opuwo, both from the production and consumption sides, gathering information at the region and city level, as well as on households and individuals, on numerous relevant elements. Both quantitative and qualitative data were gathered through surveys and in-depth interviews, which provided structure while allowing flexibility for deeper investigation into areas that called for it, thus complementing the multi-dimensional character of UPA.

All information and data were collected during a six-week period, from March to April 2016, on site in Opuwo city and its peri-urban surroundings by the author, M. Thuening (University of Cologne, Germany) and research colleague, S. Kadhikwa (University of Namibia), hereafter referred to as the 'research team'. The research design was separated into two phases, consumption and production, which reflect objectives 1 and 2 of the study.

3.3.1 Consumption

To understand the backdrop of the local food system, the first phase of the research was to conduct a market assessment. Market analyses are vital to discerning a food supply chain and are useful in gauging the role of UPA in a particular locale. A market assessment should gather information such as market locations, participants, types of produce, relationships and linkages, and also to identify the role of formal and informal sectors (Martin, Oudwater, & Sabine, 2001, p.20). The market assessment in this study first explored the market landscape in Opuwo providing a qualitative description of the main formal markets, as well as the solitary informal market. Next, both qualitative and quantitative data were collected on staple commodities, including producer names, prices, weights of sale units, and origins of goods (see Appendix I for the Market Survey Template).

3.3.2 Production

The second phase of the research design was to gain insight on UPA production activities. This involved conducting semi-structured and in-depth interviews with representatives from government agencies, a non-governmental organization (NGO), and farmers. The research team designed and followed a semi-structured questionnaire (see Appendix II). The aim of the survey was to gain information regarding locally produced crops, average yields, use of harvests, and farmers' greatest challenges. A strength of this production study was to use the questionnaire template as a framework to interview both agency officials and farmers in the field, ensuring that certain information points were gathered from both perspectives. Additionally, data from academic and official government publications, as well as knowledge gained from the market survey, are taken into consideration in the discussion chapter of this

thesis. This use of data source triangulation assisted in gaining a comprehensive picture of production. By converging the data and knowledge which we obtained from various sources, we are able to certify accuracy of information while gaining a comprehensive understanding of the different dimensions of UPA in Opuwo.

Agency Interviews

As Martin et al. (2001) mention, key informants are interviewees with expert knowledge or specified responsibilities and can be instrumental in highlighting information that is of particular interest and can offer insight into legal and institutional framework (p.21). Key informants in this study worked with the following governmental and non-governmental agencies: Ministry of Agriculture, Water and Forestry (MoAWF) (group and individual interviews), Ministry of Land Reform (MoLR), and local NGO Conservation Agriculture Namibia (CAN). The interviews typically lasted 45 to 75 minutes and were conducted in English. As mentioned, the farmer questionnaire was used to structure the interviews, but certain topics were covered in more depth.

Farmer Interviews

The research team interviewed farmers on seven sites during the study period using two different sampling methods. One group of farmers were selected using snowball sampling, a non-probability sampling technique where research informants identify other informants. An initial visit to the local farmers' association, Zakumuka Farmers' Cooperative (connected with CAN), as well as a personal contact, referred further respondents. This first group yielded farmer respondents in peri-urban areas. A second group of informants were obtained by a transect walk through agricultural fields directly adjacent to Opuwo's main road and city center. This second group yielded respondents in urban areas. Interviews were conducted either in English, or in the local language, Otjiherero, with the assistance of a local translator, and lasted between 30 to 45 minutes. Two of the nine respondents were selected for in-depth interviews, as they offer specific case studies of entrepreneurial UPA activities.

Chapter Four: Results

This chapter summarizes results from the field work. The research team interviewed various ministries, organizations and farmers in order to gain a holistic and comprehensive understanding of UPA in Opuwo. Results from the market survey are presented first, followed by a detailed look into food production, following the structure of objectives one and two.

4.1 Consumption

This section begins to outline the food chain. Herein are described the markets, the commodities at market and their prices, and finally a note on the origins of goods.

4.1.1 Markets in Opuwo

There are four formal markets in Opuwo city including both international companies and local markets, and there is one small informal market, all of which are described herein. OK Grocer Opuwo is a relatively large supermarket. This South African franchise offers a wide variety of products, including fresh baked goods, canned and preserved goods, and fresh fruits and vegetables imported primarily from South Africa. The other large supermarket is AGRA, a Namibian-based agricultural company which has a retail location in Opuwo. AGRA sells not only foodstuffs, but also agricultural equipment and various other consumer goods. They offer no fresh produce, and instead focus on food staples in bulk, such as maize meal in 50 kg sacks. Finally, Powersave and Opuwo Supermarkets are two small locally run stores which offer similar types of products as the previously mentioned markets, but with a limited selection.

Finally, an informal market is located behind the two larger supermarkets in the centre of the city. Sprawling no more than 200 m^2, the market is comprised of several meandering rows of stands. A few sturdily-constructed stands host salespersons touting fried bread, loose bundles of firewood, or slabs of freshly butchered goat meat, ready to slice off the customer's preferred cut. In stark contrast to these active stands, much of the market lay in disrepair, with derelict abandoned structures lining mostly empty market streets.

4.1.2 Market Assessment

The standard local diet in Opuwo consists of maize meal and millet meal (known throughout Namibia as "mahangu") prepared as a thick porridge, and accompanied by beef or goat meat in a sauce. Vegetables are only occasionally added to meals.

In conducting the market assessment, the research team compared the most common staple commodities at OK Grocer, AGRA, and Opuwo Supermarket. Items and prices at all markets were found to be approximately equal, and thus information listed herein are the average list

prices for commodities across all markets in the city. Results of the market assessment are summarized in Table 1. Section 1 of the table presents the prices and origins for staple foods: maize meal, mahangu meal, rice, wheat flour, sorghum porridge, sugar, and potatoes. Section 2 provides information on maize seed, as some farmers interviewed in this study stated that they bought their seeds from the supermarkets in Opuwo.

Table 1. Market Assessment Results.
(Source: Data collected in Opuwo, March 2016)

Section 1. Staple Foods					
Item	**Brand Name, Producer**	**Price (N$*)**	**Weight (kg)**	**Price per kg**	**Labelled Origin**
Maize Meal	Number One, Namib Mills	35	5	7,00	Produced in Namibia
	Number One, Namib Mills	78	10	7,80	Produced in Namibia
	Number One, Namib Mills	366	50	7,32	Produced in Namibia
	Top Score, Namib Mills	96	10	9,60	Produced in Namibia
	Top Score, Namib Mills	281,35	25	11,25	Produced in Namibia
	Namib Sun, Namib Mills	52,45	5	10,49	Produced in Namibia
	Bokomo	51,65	5	10,33	Produced in Namibia
Millet (Mahangu) Meal	Meme Mahangu, Namib Mills	133,87	10	13,39	Produced in Namibia
Rice	Namib Mills	12,99	1	12,99	Grown in China or India, and Grown in Thailand or Brazil
Wheat Flour	Bokomo	50,99	5	10,20	Produced in Namibia
	Bakpro, Namib Mills	65,95	5	13,19	Produced in Namibia
Sorghum Porridge	Morvite	18	1	18,00	South Africa
Sugar	Marathon Sugar	62,5	5	12,50	Packaged by Tongaat Hulett in Walvis Bay, Namibia
	Sugar King, Namib Mills	13,3	1	13,30	Produced in Namibia
Potatoes	no brand	166,99	10	16,70	South Africa
	no brand	99,99	7	14,28	South Africa
Section 2. Seeds					
Item	**Brand Name, Producer (Product Name)**	**Price (N$*)**	**Weight (g)**	**Price per g**	**Labelled Origin**
Seeds	Starke Ayres (Hybrid Sweetcorn "Inferno")	18,53	5	3,71	Packed in South Africa
	Starke Ayres (Mealie Maize "Zama Star")	18,53	5	3,71	Packed in South Africa
	Mayford, Sakata (Sweet Corn "Stowells Evergreen")	20,14	10	2,01	South Africa
	Mayford, Sakata (Sweet Corn "Golden Bantam")	20,14	10	2,01	South Africa

** Prices listed in Namibian Dollars. Exchange rate at time of survey: 1 Euro = 17.18 N$; 1 USD = 15.47 N$*

A wide selection of maize meal products was on sale at the markets, offering consumers various size packaging (5-kg to 50-kg), and a range of different qualities. For example, "Number One" was considered a low-end product, while "Top Score" was high end. On the other hand, there was only one mahangu meal brand on offer at the market, despite it also being considered a staple food. The practice of selling bulk packages for a lower price was not observed in Opuwo supermarkets.

Staple commodities were most commonly labelled as "Produced" or "Packaged" in Namibia. Indeed, domestic production of the staple foods maize and mahangu partially fulfils domestic demand, however the exact proportion of what was procured locally, or in Namibia nationwide, verses what is imported was not clear through the field investigation.

Fresh produce was almost exclusively available at OK Grocer, with occasional bags of potatoes on offer at the Powersave and Opuwo Supermarkets. The vast majority of fresh produce was imported from South Africa and was considered to be either out of the price range of, or simply

not of culinary interest to, much of the consumer base. Local farmers intermittently set up shop outside of OK Grocer to sell his/her harvest of the day.

4.2 Production

The market assessment provided a general picture of what commodities were available in Opuwo at the time of assessment, thus providing a starting point for understanding the food system in the area. From here we continue to develop the picture of UPA in Opuwo by delving into the production side, first taking into consideration some contextual topics to set the scene, and then detailing the situation of local farmers on the ground. All respondents whose names have been included, had explicitly given consent for their identification.

4.2.1 Contextual Considerations

Land Tenure

The legal status of land tenure at the national level was mentioned in the literature review. In order to understand how this has affected farmers at the local level, the research team interviewed two officials in the MoLR. Chief Development Planner, Mr. I.U. Tjipepa, noted that although there have been various legal and administrative developments advocating for land reformation, reallocation, and stronger rights for local land holders on the national level, its reach to local areas such as Opuwo "has not impacted people's lives much". The most prominent activity the local ministry is involved in is land parcel registration, which began in Kunene in 2003, along with the process of parcel digitalization in 2010. While potential benefits of applying for land tenure and going through the process of registration can offer benefits such as security and access to finance, most parcels around Opuwo remain unregistered, with an estimated meagre 5% of parcels registered as of 2016, according to Mr. M.H. Karunga, GIS Officer. Further, it is common practice to informally sub-lease portions of one's land to newly-arrived migrant farmers, thus negating any potential advantages of registration for those working on the land (for more information on land registration see Appendix III).

Land Degradation

As mentioned, northwest Namibia has historically been a pastoralist society. In order to understand the current state of pastoralism in the area, the research team conducted a group interview with nine cattle farmers and were guided around a communal pastureland area. The cattle farmers recounted how the land has changed over the past several decades. Prior to the establishment of the area's two boreholes in 1998 and 2013, farmers herded their cattle between pasturelands and a natural spring approximately 7 km away. Prior to the year 2000,

farmers noted slow changes in the environment, however after 2000, the land began to degrade quickly. The land turned from savannah grasslands to bare soils spotted with mopane bushes. There is less rainfall, but when it comes it runs-off the naked soil rather than infiltrating into it, cutting through the landscape, carrying away fertile topsoil and leaving gaping gullies in its wake. The farmers credited these changes to overgrazing, overstocking and insufficient precipitation, and proposed that if the land were to rest the grasses would come back. As proof, the farmers pointed out a felled acacia tree during the field walk, underneath which grass was growing again, as its thorny branches prevented cattle from reaching the vegetation. Management was cited as a huge challenge on communal areas. Even if local farmers were to restrict grazing the land, they could not prevent outsiders from coming in to use the land during that interim period. Further, for cattle farmers to rest for a year would mean a loss of their main livelihood for a year. Their recounts of cattle farming and pastureland degradation in the Northwest mirrored that which has been recorded in relevant literature, as noted in chapter two.

Figure 6. Severe land degradation, erosion and gullying.
(GPS Coordinate: S 18° 19' 25" E 13° 82' 37". Photo by N. Ibo)

Similar concerns of land degradation were expressed by governmental officials in the Crop Division of the MoAWF. The ministry is responsible for supporting agricultural activities in all of Kunene. They conduct farmer trainings on cropping practices (e.g. row planting and applying soil amendments), rent out tractors for ploughing, and provide livestock management education. During an in-depth interview, Ms. E. Handunge, Chief Agricultural Scientific Officer,

emphasized how over-grazing and deforestation on communal lands is leading to desertification in the region. She related the same problem of uninterrupted grazing denuding the land of its once hardy native perennial grasses resulting in massive erosion and gullying. Further aggravating the situation, farmers deforest the land to harvest material for building and renovating fences each year. Figure 6 shows an example of the land degradation around Opuwo, where erosion has led to a complete transformation of the landscape.

Water and Climate

Water and climate challenges are the greatest concerns for local producers, according to the MoAWF. In such an arid country as Namibia, agricultural activities are completely dependent on rainfall. While the average annual rainfall over the past 30 years in the area of Opuwo has been approximately 300 mm, recent years have brought increasingly extreme weather events. For example, the 2014 / 2015 season experienced one of the worst droughts in recently recorded history. Between November 2014 and March 2015, what is usually the rainy season, the greater Kunene region received an average of 51 mm of precipitation, with Opuwo receiving a meagre 48 mm (unpublished data from MoAWF). As a result of this drought, many cattle farmers lost the majority of their herd, and some their entire herd. Thus, their economic savings, so to speak, was lost. In a region where many people manage cattle as their main source of income, the increasing prevalence of droughts are proving devastating.

According to Ms. Handunge, in response to these climatic changes, cropping activities amongst farmers who were previously solely livestock herders have been steadily increasing over the years in an effort to diversify livelihoods, and thus reduce dependence on cattle as the single source of food and income. As the number of stationary farmers increases, so does the land area which is converted to cropping. However, she stated that it is not yet clear if the expansion of cultivation has proved successful for farmers, as crops are also vulnerable to water scarcity. Further aggravating the matter is the delayed onset of the rainy season. Over the past few decades the wet season has been starting later and later in the year. In a good year, the rainy season starts in October or November, and sowing starts soon thereafter. However, since the first major rains of the season have been coming later in recent years, the period of sowing is also pushed back, translating to a shorter growing period. In 2016, the peak planting period was mid-January. Ms. Handunge attributed this to climate change.

4.2.2 Farming Overview: Perspectives from Agencies

The interview with MoAWF officials provided a general overview of cropping in and around Opuwo, which is detailed here, followed by a brief interview with CAN.

Although there are efforts to keep records and collect data on agriculture in Kunene, no comprehensive database exists. There are only data from randomized samples and select segments of the population. For example, a 2014 / 2015 unpublished report proffered during an interview with Chief Agricultural Technician, Mr. E. Simwanza, indeed provided valuable information, yet it only collected data from farmers who were then registered with the ministry and had applied for tractor ploughing services that year. In 2014 / 2015 there were 2,721 registered farmers (1,652 women; 1,069 men), and 713.82 ha of land ploughed by government tractors. However, according to the MoAWF, the vast majority of farmers and their land are unregistered and are increasing annually, as was also explained by the MoLR.

Some farmers live at or near the farming site, whereas others are “brief-case farmers”, a term used for part time farmers that have a full-time job in the city and only farm on the weekend. The average plot size is 1 ha, but it is not uncommon to find some larger parcel sizes of 2 to 3 ha. The most common crops cultivated in Kunene are maize and cowpea, which are often intercropped. The success of cropping varies with the irrigation scheme in place on any given parcel of land. The majority of farmers cultivate on small parcels which receive only rainwater or run-off during the rainy season. Irrigation with groundwater is rare, as it costs N$ 80,000 – N$ 200,000 to drill a borehole which is an exorbitant cost for most Namibians. Thus, according to the MoAWF, irrigation in the area can be separated into two categories: Rain-fed and Run-off. Rain-fed irrigation means that the rainwater that falls onto the surface of a piece of land is the only water the land receives. This land is generally flat and located higher in the watershed. This is the least desired land and, as it receives little water, crops have a higher probability of failing, as compared to crops cultivated on run-off irrigated parcels. It is not unusual for a land holder to sub-lease portions of their holding to newly arrived migrant farmers, which is often the worst part of the land and under rain-fed irrigation. Alternatively, land resting in close proximity to an ephemeral stream is watered via run-off irrigation, meaning a farmer diverts run-off water onto their field. The amount of water diverted to a field depends on the location of the land in the watershed. Farmers with parcels further downstream or a greater distance from the stream struggle to compete with farmers closer to the stream source. In summary, the location of a land parcel significantly influences the outcome of cultivation, which makes it difficult to conclude if expanding cropping has been a successful strategy against drought, as there are both winners and losers.

Gathering statistics on yield is a challenge for the government agency, as people begin consuming their produce directly after harvest when it is still fresh, and therefore there is no opportunity to systematically record dry yield weights. However, rough numbers can be estimated. The MoAWF estimates the average yield of maize is 400 kg/ha in a year of good

rainfall (unpublished report from MoAWF). However, in the same report, one farmer recorded a 1,000 kg/ha harvest, while eight others recorded no harvest at all due to lack of precipitation. Sales are limited. Most of the harvest is consumed at home or exchanged with other farmers for crops or livestock.

Land is prepared most commonly by hand, and less commonly with the assistance of animal or tractor ploughs. Tractors were introduced by the government in the 1990s, and later also sold to private farmers. Ploughing services from a private tractor is N$ 550 – 700/ha. Subsidized services from the government tractors cost the farmer around N$ 150/ha.

Regarding inputs, labor on the farm is performed either by family members or hired hands, be it local laborers or migrants from Angola. Fertilizers and pesticides are very seldom used, especially chemical inputs. Seeds are procured from various sources. Maize seeds are often either subsidized or given for free from the government. There are different varieties of maize planted throughout Kunene – some are of a short growing season strain, and often are hybrid stock originating from Zambia. Commonly planted strains of millet are locally produced at an agricultural research station approximately 100 km away. Similar to maize, millet seeds are either sold or distributed for free by the government. It is not uncommon for farmers to save seeds from their own harvest, however only when their yield proves abundant enough.

Besides the MoAWF, the research team also met with and interviewed a local NGO. Some farmers are part of a farmers' association, the Zakumuka Farmers' Cooperative, which was established in 2012 with financing from the Namibian firm Meatco and the European Union, in order to support local farmers in livestock management. The association, composed of 135 paying members, is supported by CAN, an NGO through which they promote "conservation agriculture" cropping methods. CAN offers its members training workshops, manages pilot projects, and hires out tractors. In an interview with the Regional Manager of CAN, Mr. U. Kapi, it was noted that cropping has not historically been extensive in this area. Similar to what the ministry mentioned, farmers do not have abundant yields but what is harvested is exchanged with other farmers for goats or cash money rather than selling at the market. The NGO advocates the use of conservation agriculture techniques for cropping, which are intended to optimize water resources and maximize yields. Techniques include ploughing 30 cm deep furrows for water harvesting effects, adding manure prior to the rains, and then planting shortly thereafter. Further, farmers should leave 30% of crop residues in the field to retain soil moisture, promote fertility, and prevent erosion. Although these methods impart higher labor costs, farmers are expected to achieve higher yields. Still, Mr. Kapi noted that challenges, such as inadequate precipitation, lack of tractors, and incomplete adherence to the techniques, hinder full realization of the benefits of conservation agriculture methods.

4.2.3 Farmers in Opuwo

The research team interviewed 9 farmers (6 men, 3 women) on 7 farm sites. Their ages ranged from 35 to 64 years old. Six farmers belonged to the Herero ethnic group, and three farmers to the Himba group. Seven of the nine interviewees stated farming as their main economic activity. Other income sources included old-age pension, full-time salaried employment in the public sector, and making jewellery for a minor supplemental income. All respondents live on-site or within 10 km from their parcel, except for one couple who live in a village 45 km away and live only part-time near their urban plot. The five respondents who farmed inside the city boundaries had all been doing so for two years or less, while the peri-urban farmers had all been cultivating crops for longer than two years, some for ten years or more. Every farmer gained permission from local leaders to use the land, but only the two "brief-case farmers" took the steps to register their parcel with the MoLR.

Parcel sizes ranged from less than 1 ha to 3.4 ha, with one farm laying outside this range at 14.6 ha. The number of people who are fed from the farms range from 9 to 15, with an average of 11.5 people. However, farmers stated that not all family members live at home, and they must send food to family members in the city or to children away at school. Further, the number of family members that eat from the harvest may change year to year.

Production Practices

Maize was the main crop for all but two farmers, consequently composing the majority of the sowed land area. The next most common crops were beans (cowpeas), pumpkins, melons and watermelons. Although mahangu is a staple food in Namibia, only one farmer sowed millet.

Sowing typically took place in January of that year, with one farmer adding that planting can happen as early as December and as late as February depending on when the rains come. Harvest occurs between May and July, but no farmer could give a precise time, and it was repeated that farmers simply harvest "when it's ready".

Farmers prepared their land either with a hoe, or by tractor, or both. From the six farmers who stated that they prepared their land by tractor, two rented a tractor from a private person but would like to rent the government tractor in the future as it is more affordable. Three were members of Zakumuka Cooperative and thus employed their services at a rate of N$ 300/ha. These three farmers followed conservation agriculture principles, such as rip furrowing, measured planting, using ground cover, and crop rotation.

Regarding inputs, seeds were obtained through a mix of different sources. Two farmers bought their seeds from the local supermarkets AGRA and OK Market. Others secured their seed supply by saving their own seed from last year's harvest, purchasing from abroad, or procuring

free seed from the government, the cooperative, or the FAO. Use of industrial fertilizers and pesticides are almost non-existent. One farmer was quoted as using them on occasion, and another farmer mentioned that he was aware that the seeds he planted had been pre-treated with a pesticide.

Labor on the farm for all cases was done by family members, and four farmers mentioned hiring one to two farm hands for help. One farmer said he hires outside labor only occasionally, when he has the money to do so. Farm labor is composed quite equally of men and women. The origin of outside laborers is evenly split between workers who come from the Opuwo region and those coming from Angola.

As stated by the MoAWF, it is difficult to estimate yield. This was confirmed during our own field work, as no farmer could provide yield numbers. However, one farmer estimated a 400 kg/ha yield of maize, noting that this is calculated for the entire ear of maize (including the cob, not only the kernel). This farmer sold his maize for N$ 8/cob and also exchanged a portion for goats. On the other side of the spectrum, one farmer said that she had no harvest last year due to water scarcity, however she will plant again this year in hopes for a harvest.

Constraints and Challenges

This leads back to the biggest constraint that farmers encounter: water. All farmers depended on irrigation from rain water and/or run-off, except for the two “brief-case farmers”, which will be detailed in the following section. The farmers who expressed less concern for water were those who were located in close proximity to ephemeral rivers, and explained how they channel the run-off into their fields when the rains come. The farmers who are not located close to a stream are wholly reliant on whatever rain may fall onto their fields throughout the season, and thus are much more vulnerable to low precipitation rates.

Pests are a challenge for all farmers. Termites, caterpillars, and the armoured ground cricket (*Acanthoplus discoidalis*) were the most commonly cited pests causing crop damage. Yet, the variety of intruders runs the gamut, everything from various insects and worms, to birds and field mice, through to livestock cattle, pigs, goats, and donkeys. The farmers generally deal with these problems by physical means – picking insects off the plants or chasing away the larger beasts.

The other major difficulty mentioned amongst the farmers was a shortage of financing to purchase tools and building materials, especially fencing. For those who only prepared their land by hand, they wished to have access to tractors or animals for ploughing in future years.

4.2.4 Special Cases: Entrepreneurial Farmers

As mentioned throughout the previous section, two farmers proved exceptions in various production practices. Both are “brief-case farmers” who work salaried jobs in the public sector in Opuwo city and farm only part-time in peri-urban areas. Both farmers approached farming from a business stance, exhibiting exceptional ingenuity and ambition. Therefore, in-depth interviews and site visits were conducted, results of which are included herein.

Case Study 1

Mr. M. Bura has been growing banana trees since 2013, starting with a single plant which was given to him by a friend, and over the years has propagated them to what is now 119 trees. As he does not have sufficient water resources to irrigate the trees enough to bear fruit, he sells the trees for N$ 50/tree at the roadside and to friends. Besides the banana trees, he experiments with other crops such as losane (for animal feed), spinach (for sale), sun flower, chilli, tomatoes (for sale), mango, pawpaw (for sale), onions (for sale), butternut squash (for sale), groundnut (newly planted), sorghum (for animal feed), beetroot and watermelon.

Marketing strategies include direct sales outside of OK Grocer on Saturdays, distributing produce at the informal market and collecting a percentage of sales, and selling to local restaurants.

Mr. Bura is the sole commercial chicken farmer found in the Opuwo area. At the time of the interview, he was raising 300 chickens of a breed locally known as “Marathon Runners” from South Africa for meat with the aim to sell them at the local state fair. He further added that he intends to expand to include an egg laying operation. The chickens are free range, grazing under the banana trees.

His greatest challenges are inadequate water supply and complications with land tenure. The plot is located in a dry area, outside the vicinity of the seasonal flood plain, and thus receives little water naturally. NamWater, the national public-private water utility, pipes water to Mr. Bura’s farm, of which 7,000 – 10,000 litres goes to the chickens and crops per day. Water costs reach N$ 1300/month, N$ 900 of which supplies the drip irrigation system. He stated that he dreams of drilling a borehole on his property, which would in turn allow him to ensure stable production and thus stable income, but drilling to the 50 – 100 m water table would cost between N$ 40,000 and N$ 70,000. He explained that if he were secure a year-round water source he would become a full-time farmer.

The other issue lies in land rights. As the parcel is on communal land, he must acquire permission from traditional leaders to use the land. However, there are three leaders in charge of the area and they are caught up in disagreements over land issues with one another. The

lack of inconsistency and conflict between leaders is a problem “particular to the Opuwo region”, according to Mr. Bura.

Besides his business initiative of raising unique produce for direct sales at market, he opens the farm to schools and gives educational tours to the community.

Case Study 2

Mr. H. Mumbuu shares a 14.6 ha parcel with three other farmers, which they have named “Villa Vandu Community Garden”. They acquired the land in 2002 with a 99-year lease-hold but he did not start farming on it until 2010. They have applied for another 33 ha of land, which is currently in process with the MoLR.

In the past he had 130 head of cattle but the entire herd died in the drought in the previous year and thus he currently focuses on cropping. Besides selling fresh produce such as pumpkins, onions and carrots at the markets, he donates a portion of his yield to local schools once a year. He also raises banana trees for sales, along with several other unconventional crops.

Mr. Mumbuu was the only farmer interviewed who had acquired funding from national and international organizations in order to finance his operations. In 2014, the FAO provided N$ 100,000 in capital for materials such as a 10,000 L water storage tank and drip irrigation equipment. Unfortunately, the drip irrigation system was not in use, as he stated that he needed expert advice, labor, and additional material to install it. Further, the Namibian government funded N$ 50,000 in 2016 for borehole pipes and a generator. In 2012, he purchased solar panels from the Ministry of Energy & Mining and is paying it off through monthly instalments. Still, water shortage is an obstacle, as is market access. He aspires to open his own shop in town in the future to sell his produce.

While these two farmers are still in the early stages of establishing their agro-business, they provide an example of emerging commercial family farms in peri-urban Opuwo areas.

Chapter Five: Discussion

By bringing together results from the field research with perspectives from literature, as well as data on local contexts, the discussion section explores potential causes behind the expansion of UPA crop cultivation, thus addressing the main research question. The structure of this section corresponds to that of the methods and results, addressing first consumption (5.1) and second production (5.2). The main points of the results are drawn out and their implications discussed. In the third part (5.3), these implications are examined through demographic, socio-economic, and environmental lenses, and conclusions are proposed relating the results to the overall research question. Through this discussion, I endeavor to identify the main factors influencing the expansion of UPA in Opuwo.

5.1 Consumption

Similar to other small cities in sub-Saharan Africa, residents of Opuwo acquire food from multiple sources, including their own urban and/or rural farms, transfers from family and friends, and market purchases (Ayerakwa, 2017). This section discusses the role of markets in Opuwo, the changing market landscape, as well as food commodities and their origins.

5.1.1 Market Landscape

The food system in Opuwo has undergone significant changes in the past few decades. As explained by Prof. Dr. M. Bollig (personal communication, 4 Dec 2017), throughout the 1980s and 1990s, there were few options for consumers. The informal market was small, and only a limited selection of commodities was available at the local Powersave supermarket. In the early 2000s the informal market expanded, offering consumers not only foodstuffs, including produce coming from Oshakati, a nearby town, but also clothing and other goods. During this time period, supermarkets entered the scene, starting with the Namibian firm AGRA, and later OK Grocer, a franchise brand under the extensive South African firm Shoprite. In 2016, when the fieldwork was undertaken, the local informal market was found to have dwindled and fallen into disrepair. Most recently, SPAR supermarket, a multinational franchise run under SPAR Group Limited, South Africa, opened its doors in 2017.

This proliferation of South African supermarkets is not unique to Namibia. As the South African retail market reached near saturation in the 1990s, corporations began advancing across the continent, first targeting high-income urban consumers and later moving into poorer areas, taking advantage of booming urban populations, improved infrastructure, and logistical technology (Weatherspoon & Reardon, 2003).

The development of the supermarket retail sector can be beneficial for the consumer, but detrimental for local producers (D'Hease & Van Huylenbroeck, 2005; Dobson, Waterson, & Davies, 2003). Supermarkets offer consumers the convenience of one-stop shopping, relatively low prices, and a wider selection of products than they would otherwise have. These factors, however, can have far reaching and unforeseeable consequences. For example, the introduction of new products can alter consumer tastes and thus diets, as seen in the early 2000s in Opuwo when cheap white bread was introduced onto the market and has since flourished (M. Bollig, personal communication, 4 Dec 2017). Moreover, with Kunene being very vulnerable to food shortages (NSA, 2015a, p.45), the reliable availability of increasingly cheaper foodstuffs could bode well for the food security of its residents, as it detaches the food chain from local climactic shocks such as drought. This may be even more crucial as urban population numbers continue to climb and local producers are not well-positioned to supply this demand.

Yet from the farmers' side, the penetration of international supermarkets into local food chains can potentially pose a serious threat to their livelihoods, considering that South African supermarket retailers tend to import from their established distributors rather than to source locally (Emongor & Kirsten, 2009; Weatherspoon & Reardon, 2003). When they do source locally, supermarkets dictate the terms of purchase, setting stringent requirements for volume, quality, price, packaging and delivery, to which generally only large farmers or outgrower schemes can comply. These high barriers to entry in effect exclude small-scale local producers from participating in the retail supply chain, leaving traditional markets as the only outlet for such farmers to sell their surplus.

How does this affect farmers in Opuwo? Seeing that 47% of the population of the greater Opuwo constituency practices agriculture as their main source of income (NSA, 2014a, p.vii), and taking into account the gloomy state of the traditional informal market channel, the rising hegemony of South African supermarket franchises could theoretically present a major setback for local farmers, as it has in other countries. Imports can be detrimental to producers by undermining pressure for local agricultural intensification (Boserup, 1981, p.202), and can cut local producers out of the retail food chain. However, I argue that, while this may potentially pose a threat for livestock farmers around the northwest Namibian city, the presence of supermarkets is unlikely to play a significant role in the lives of most local crop cultivators, as cropping has not been a commercial enterprise in the area and most farmers produce almost exclusively for home consumption, rather than for income generation. Thus, the proliferation of supermarket chains does not appear to play a significant role in growth of UPA.

For the entrepreneurial farmers, the appearance of international supermarkets on the scene carries more weight. The presence of supermarkets can be a blessing or a curse - either it can be an opportunity for local agro-businesses to tap into a growing customer market for fresh produce, or conversely the local business-minded farmers might be completely shut out of the retail market chain. Considering that both entrepreneurs are in the early stages of establishing their businesses, it is too soon to remark on the role that South African supermarkets will play in their business strategies.

5.1.2 Commodities and their Origins

After looking at the markets in general, we now take a closer look at the commodities on offer within them. Herein are highlights from the market survey, supplemented by discussion points. Despite maize being highly susceptible to water stress and thus vulnerable to environmental shocks like drought, it has pervaded nearly every ecological niche on the African continent in 500 years, supplanting more drought resistant “historically African crops” such as millet and sorghum to become a primary staple food (McCann, 2005, p.8). For generations, the prevalence of maize has been manifested in national dishes, comprising 50% of caloric intake throughout southern Africa, and accounting for 33% of cereal consumption in Namibia (McCann, 2005, p.7; Shifiona et al., 2016, p.70).

Results of the market assessment in Opuwo reflect this continental trend, confirming that maize has indeed penetrated the markets and diets of northwest Namibia. The main commodity on the market is maize meal, with four different brands of varying qualities and several packaging sizes on offer, occupying the greatest shelf space relative to other goods. Millet, rice, wheat flour, sorghum porridge and potatoes offered shoppers considerably less product choice, with one or two brands available. From this, it was apparent that maize meal holds higher market share than the other staple foods. This coincides with national statistics, which affirm that the average Namibian consumes 44 kg of maize per year and 29 kg of millet (Shifiona et al., 2016, p.70).

The dominant status of maize in the national diet may be connected to economic motives; maize meal is the least expensive staple food on the market. The price per unit for maize meal ranges from N$ 7/kg - N$ 11.25/kg depending on the brand, whereas other staple goods start at N$ 10.20/kg for wheat flour and go up to N$ 16.70/kg for potatoes and N$ 18/kg for sorghum porridge. Food prices in Namibia tend to be relatively unstable, trending upwards in recent years, with a 13.2% inflation rate between January 2016 and January 2017 alone, according to the Namibia Consumer Price Index (NSA, 2017a, p.4). Considering that 28% of Namibian households spend 60% or more of their monthly income on food, increases in food prices place

low income families' food security in jeopardy (Froystad et al., 2009, p.6). Another inference that can be drawn from this market study is related to the income level of the average Opuwo consumer. A common strategy for supermarkets to promote sales is to sell bulk package sizes at discounted unit prices (Chandon & Wansink, 2012; Rischke, Kimenju, Klasen, & Qaim, 2015). However, low income consumers often lack the liquidity to buy bulk items and thus cannot reap the benefits of these quantity discount pricing schemes (Rao, 2000). The absence of this pricing pattern, particularly notable with maize meal products, speaks to the prudent marketing strategies of Opuwo supermarkets in catering to a lower-income consumer base. More on incomes, pricing and the relation to UPA will be discussed in section 5.3.2.

Regarding product origins, all maize in the marketplace was labelled as produced in Namibia. Although Namibia is a net importer of food, facing a rising demand for maize alongside an expanding population, the domestic agricultural sector manages to fulfill approximately 50% of its maize requirements, most of which is grown either in the more fertile north-eastern regions or on governmentally supported projects such as the Etunda irrigation scheme (Froystad et al., 2009, p.3; Low et al., 1999; Shifiona et al., 2016). However, as local agricultural production is highly dependent on precipitation, a volatile element of Namibia's climate, it is probable that Namibia will continue to depend on imports to cover domestic production deficits.

The prominence of imports is clear for other commodities. For example, Emongor and Kirsten (2009) found that 80% of all processed foods which were marketed in Namibia, Botswana and Zambia were sourced from South Africa (p.60). They add that the participation of local small-scale farmers in the supply of fresh produce in Namibia is "almost non-existent", due to limited production. This correlates with observations from the market survey in Opuwo. Fresh fruits and vegetables in the supermarkets are scant, and essentially all produce that is on offer travels immense distances from the fields of South Africa, landing on the shelves of OK Grocer in Opuwo. Further, the consensus gathered from our survey indicates that the demand for fresh produce from the marketplace is negligible. The high price renders fresh fruits and vegetables a luxury good, an imprudent extravagance for low-income shoppers. Yet, it was uncovered through the farmer surveys that fresh fruits and vegetables are, in fact, contributing to the nourishment of many Opuwo residents, albeit not significantly through purchase at formal markets. Thus, sales of imported fresh produce does not appear to factor in significantly to the expansion of UPA, other than perhaps the introduction of new varieties of fruits and vegetables to the local palate.

5.1.3 Summary

The findings of this market assessment uncovered the development of the formal market sector with an increasing influence of South African retail supermarkets. Maize is the major, and the cheapest, staple commodity, and demand is met through national production and imports. The small amounts of fresh fruits and vegetables which are available are imported and are largely considered expensive. While the presence of multinational firms and imported goods can have negative impacts for local farmers, as found in previous studies, the repercussions are likely not the same for the small-scale UPA farmers of northwest Namibia where there is no established commercial produce sector and local production is not sufficient to meet local demand. However, the supermarkets may prove a challenge for the entrepreneurial farmers. Instead, such factors can be positive for local consumers in terms of food security. While the market survey alone does not explain the expansion of UPA in Opuwo, it provides insights which will be returned to throughout the discussion.

5.2 Production

Having established an understanding of markets and consumption patterns, attention is now drawn to the investigation of UPA production in Opuwo. This section first integrates information obtained from agency and farmer interviews to conceptualize an overview of cropping in and around Opuwo, and then concludes with commentary on the case studies of entrepreneurial farmers.

5.2.1 Overview of Crop Farming

Referring back to the three farm types outlined in the literature review, large-scale commercial farms and small commercial family farms do not lay within the region around Opuwo, but instead what was uncovered through the survey is the prevalence of semi-subsistence family farms.

Results showed that the average plot size of farmers in Opuwo is approximately 1 ha (but 2 - 3 ha parcels are not uncommon), and that most farmers live either directly on their farm or within 10 km. While close proximity to the city center can be a benefit for UPA due to market access (de Bon, Parrot, & Moustier, 2010; Gerster-Bentaya, 2013; Obudho & Foeken, 1999), the market survey revealed that local farmers' presence at the market is negligible. Therefore, proximity to markets is not likely a factor in UPA expansion because locally produced goods are not sold at market.

Diversification of income is frequently cited as a reason for UPA practice, as noted in chapter two. Results of farmer interviews suggest that this may also be an aspect in Opuwo, as most

farmers cited having other income sources including: pension, government assistance, minor income generating activities, and full-time salaried work, which reflects national and regional data (NSA, 2014a, p.100; NSA 2015a, p.52). It can be concluded that people of all walks of life, from various socio-economic backgrounds participate in UPA, although motivations can vary, from food security to profit making.

The crops that farmers select to cultivate are predominantly maize, followed by cowpea, pumpkin, and melon. This confirms the preference for maize as a staple food, and suggests that there is consumer taste and thus a potential market demand for fresh produce. Still, local farmers focus on producing for home consumption, which is unsurprising considering low yields. There is not enough produced to fulfill their own household demand for the entire year, let alone to take to market.

Reliable data on local yields doesn't exist. To venture a rough guess, the average yield estimate from the MoAWF can be used along with data from literature. If the average farmer can produce 400 kg/ha of maize, and the average Namibian consumes 44 kg maize annually (Shifiona et al., 2016, p.70), one hectare planted with maize would feed 9 people. However, with erratic precipitation which leads to low yields, as well as varying dietary patterns from region to region, this can only be taken as a very rough calculation. Looking to national census numbers is of little assistance here either, as it states the average yield for maize nationally is 1.6 tonnes/ha (NSA, 2015a, p.25), a figure which is skewed by the governmentally subsidized irrigation projects. Perhaps the only attestable knowledge gained regarding yields is that no respondent was able to meet their household's dietary needs for the year through crop cultivation alone, and all stated that it was necessary to purchase maize meal when their granary was empty. Similar to the case study of a Himba group farming north of Opuwo mentioned in the literature review, UPA in Opuwo provides a supplementary source of nourishment for farming households rather than a dependable source of income and food security.

Besides household consumption, farmers transfer their yields to relatives. The average number of people eating from a farm plot is 11.5 persons based on the farmers surveyed, although according to national statistics the average household size in the greater Opuwo constituency it is 5.2 persons (NSA, 2014a, p.vii). While a person may not be living at the farm, they may still be dependent on its harvests. Several farmers related this need to feed extra mouths, explaining that they must provide food for family members living away from home or for children attending school. While rural-urban migration is often portrayed as uni-linear, with cash remittances flowing from urban areas back to rural homelands, a growing phenomenon throughout Namibia is being witnessed in which agricultural goods flow from rural areas into urban areas to assist financially struggling family members in the city, and has become a "key

survival factor" for urban migrants (Frayne, 2007, p.91). This need to transfer food to extended family members creates additional demand for a household's agricultural produce, thus putting pressure on the farmer to maintain or increase production, which may be another factor explaining the expansion of UPA. More on rural-urban migration dynamics and how it relates to UPA will be discussed in upcoming sections.

Although the demand for produce is present, farmers exhibited a cautious approach regarding financial investments in their agricultural operations. Inputs which carry high costs, such as agro-chemicals, transport vehicles, heavy machinery, storage infrastructure, land rental fees, an extensive workforce, and irrigation systems, are not common in this region. Exceptions for some farmers came from leasing tractor services for ploughing, which does not carry enormous costs when using services from the government or the agricultural cooperative. On all farm sites, working the land is most often done by hand by family members. It proves prudent for farmers to avoid heavy investments for cropping in such a dry and unpredictable climate where low or no yields is a very real threat. As stated in the 2015 Namibia Census of Agriculture, the leading cause of food shortage for agricultural households is "loss of crops / insufficient production" (NSA, 2015a, p.47). While conservation agriculture techniques are promoted by CAN as a potential solution to the risks of dry-land cultivation, uptake is limited and inconsistent, and its advantages are not always realized, which has been documented in similar cases across the continent by Giller, Witter, Corbeels, and Tittonell (2009). Major obstacles that farmers face are pests, water scarcity, and to a lesser extent, access to finance. Overall, it appears that limitations are great enough and incentives low enough that large-scale cropping is not perceived to be a wise investment. Thus, the small-scale UPA cropping which is spreading around Opuwo may provide a solution which helps farmers meet household needs, while at the same time avoiding risks.

5.2.2 Case studies of entrepreneurial farmers

Taking the opposite approach, the two farmers presented in the case studies endeavoured to circumvent such limitations by investing heavily in their operations. They expended capital on water and irrigation, labor, and infrastructure, with the aim of scaling up. What likely enables their entrepreneurial ethos is their standing as "brief-case farmers", working in the city and farming only part time. Both have a relatively stable income independent of farming, allowing them more freedom to experiment with alternative agricultural operations while not placing their basic livelihoods in jeopardy.

Another similarity between the two farmers is that their farms were located on the periphery of Opuwo. As Vermeiren et al. (2013) mention in a case study from Uganda, urban farming always

runs the risk of being dislodged by other urban land uses and pushed to peripheral locations. Assuming that Opuwo will continue to grow at its current rate, and the urban area will continue to expand, property values inside city limits will perpetually increase and large spaces suitable for cropping will dwindle. Thus, establishing farms in the more distant peri-urban areas outside city limits may prove a prudent business decision that places them ahead of the game, avoiding the threat of being pushed out of urban spaces while maintaining a close proximity to urban markets.

Both farmers benefit from growing unconventional crops, first because such crops can fetch a relatively high market price, and second, since such crops are not grown by other farmers in the area, these farmers are well positioned as the frontrunners in supplying speciality produce. Further, assuming consumer tastes adapt to more fresh fruits and vegetables with the entry of supermarkets, as has happened in Omusati (Fiebiger et al., 2010), market demand may very well increase, and thus these entrepreneurial farmers may be positioned to compete with the imports from South Africa, or to integrate into the supply chain. While they must invest heavily now, it could pay off should the business take hold as they have the potential to be the sole local sources for in-demand produce.

Finally, their attention towards community and social involvement, be it with shared gardening, donating part of the harvest to schools, or operating educational tours, serves not only as philanthropy, but also assists in their integration into the local market and could be a marketing tool in the future.

5.2.3 Summary

This section provided a snapshot of UPA production patterns and suggested how this may relate to its expansion. It was found that people of all walks of life are farming and other income sources do not necessarily determine whether a person participates in UPA or not. Most farmers focus their efforts on growing maize to meet the demands of their own households, as well as relatives who live afar. Yields generally are not abundant enough to fulfill a family's dietary needs for the entire year, but they provide a valuable supplementary source of nutrition, rather than an additional income source. This absence of sales also means that proximity to urban markets is of little significance. Farmers are generally wary to make large investments in infrastructure or operations, which is reasonable considering the risk of drought and crop failure.

Demand for fresh produce, such as pumpkins, beans, and melons, does exist, and is being met by low levels of self-production. This, however, could translate into a market opportunity in the

future, which the two emerging commercial family farmers have identified, and in which they have accordingly invested.

5.3 Potential Reasons for UPA Expansion through the Lenses

The aim of this thesis is to investigate what factors are influencing the increase of UPA cropping in and around Opuwo. Sections 5.1 and 5.2 of this chapter achieved the minor research objectives of establishing an understanding of food consumption and food production patterns, respectively. Several observations, trends and potential implications have been presented thus far. Building on this foundation, potential reasons for crop cultivation expansion in northwest Namibia are analyzed through three lenses: demographic, socio-economic, and environmental. This section is divided accordingly.

5.3.1 Demographic

Starting from a global and historical perspective, one of the most well-established theories in the field of demography is that of “demographic transition” (Kirk, 1996). This theory asserts that as a country develops from an agrarian to an industrial economy, i.e. transitioning from a “poor” to “wealthy” country, fertility and mortality rates decline, thus shifting the demographic profile of the country. The end result of this transition is that of low fertility rates and lower overall population numbers, as seen in the more industrialized countries (Caldwell, 2004). Less industrialized countries are in the midst of this transitionary path, which is apparent through decreasing mortality rates, persisting high fertility rates and high population growth.

Demographic transition plays a major role in land use changes. For example, a major effect of this transition is high rates of urbanization, both through births and in-migration (Sharma, 1979; Dyson, 2011). Further, agricultural production must be taken into account. For this, Malthus and Boserup are useful references that help conceptualize the relationship between population growth and land resources, specifically related to agricultural output.

Malthusian theory, established in pre-industrial times, stated that natural resources will check human population growth through famine, increased mortality, or self-limitation of family size. Conversely, Boserup argued in her 1965 book that the industrial revolution introduced technological innovations which made higher agricultural output possible without expanding cultivated areas, thus allowing population pressures to be alleviated by intensification (p.14). Further, the dynamic relationship between population growth and agricultural production means that increased population pressure will in fact spur innovation rather than limit population numbers.

While presenting seemingly contrasting perspectives, these two theories are not necessarily in opposition to one another, but rather can co-exist simultaneously as they both describe a response mechanism to pressures. For example, in some cases, resource pressure may lead a population to respond demographically, by reducing birth rates or migrating away from the area. In other cases, resource pressure may instigate economic responses, such as land use intensification and technological advances that in turn increase food supply. The strategy that an individual or a community executes depends on socio-economic circumstances and institutional factors, for example governmental policy regarding land ownership (Bilsborrow, 1987).

Considering the changes that Namibia has experienced throughout the 20th century, including the population boom, as well as Namibia's status as a developing country, it is fair to assert that the country is in the midst of this demographic transition. Accordingly, the population has implemented numerous mechanisms in response to rising resource pressure, which are briefly explored below, first demographic responses and second economic responses, and how this relates to UPA.

Demographic Responses

One demographic response to resource pressure is to decrease the family size. This can be seen in dropping birth rates. National birth rates have decreased, from 6.1 births per woman in 1991 to 4.1 births in 2001, and hit an all-time low at 3.6 children per woman in the most recent census (NSA, 2003, p.10; NSA, 2013, p.8). Although birth rates in Kunene increased slightly in the ten-year period between 2001 and 2011, from 4.7 to 4.9 average children per woman, they still dropped significantly from 6.2 children recorded in the 1991 census (NSA, 2003, p.16; NSA, 2013, p.15). For the greater Opuwo constituency, the 2001 census recorded an average of 6.0 births per woman (NSA, 2004, p.8), however there is no data on other years. National fertility rates for urban areas were 4.7 in 1991, 3.4 in 2001, and 3.0 in 2011 (NSA, 2013, p.41). This response is also evident when annual population growth rate begins to slow down. National growth rates show a decline from 3.1% in 1991 to 2.6% in 2001, and land at 1.4% in 2011 (NSA, 2003, p.7; NSA, 2013, p.8). At each level, from city up to country, the statistics demonstrate a general downward trend in birth rates and a slowing of population growth rates, both indicators of demographic responses to resource pressures. Yet this type of demographic response does not appear to play a role in the development of UPA.

The other demographic response is migration. Migration is often considered a result of a household's decision to diversify income sources, in effect mitigating economic risk (Stark, 1991). There have been upswings in urban migration all around Namibia, from rural areas into

small cities, and from small cities into Windhoek. This trend is apparent in the rising proportion of Namibians residing in cities. The 1991 census recorded 28% of the population of Namibia living in urban areas, rising to 33% in 2001, and reaching 43% in 2011 (NSA, 2003, p.10; NSA, 2013, p.8).

Recognizing the substantial role that migration plays in the growth of a city, I endeavor here to uncover the contribution of migration to the growing urban population of Opuwo. To calculate this, the following equation can be applied,

Natural population change + Net migration = Total population change.

The population of Opuwo in 2001 was 5,101 and grew to 7,657 by 2011 (NSA, 2015b, p.22), an increase of 2,556 people (Total population change). The question to answer here is, how many of those additional citizens result from natural births and how many from in-migration. While exact birth and death rates are not available in the census reports for Opuwo city, the crude birth and death rates – which is the annual number of births and deaths per 1,000 of the total population – from the Opuwo constituency urban data was used in order to extract the natural population change. The Crude Birth Rate (CBR) for urban areas in Opuwo constituency in 2011 was 35.0 births, and the Crude Death Rate (CDR) was 12.2 (calculated using data from NSA, 2014b, pages 4, 11 & 14). Holding the assumption that these rates do not change significantly over the 10-year period which is under consideration, the annual rate of change can be calculated. The population factor of 5.1, was derived from the 2001 population ($\frac{5,101}{1,000}$). The following calculation was run to obtain the natural population change (births and deaths):

$$(CBR - CDR)f = r$$

where *CBR* represents crude birth rates, *CDR* is crude death rates, *f* is the population factor, and *r* is the annual rate of change.

Applying this calculation, it was found that the annual natural rate of change is 116.3 persons. Meaning that in 10 years, 1,163 people were added to Opuwo's population through natural population growth, and thus 1,393 people migrated into Opuwo between 2001 and 2011. Of Opuwo's 50% population increase, 54% is attributable to migration inflows.

The increase of residents through migration connects to the growth of UPA in that many of the people who migrate into an urban setting come from farming backgrounds, have limited financial resources, and may struggle to find a formal job in their new urban home (Adedeji & Ademiluyi, 2009; Abdalla, 2012). Therefore, migrants take up farming as a means to temper economic stress and reduce poverty (Vazhacharickal, 2014).

Both the MoLR and the MoAWF noted the movement of newly arrived migrants onto marginal crop lands, offered as informal sub-leasing arrangements from long-term residents. This is also apparent in the physical expansion of croplands. The cultivated areas continue to extend further away from the ephemeral river beds, where longer-established farmers reside, into the less desired rain-fed areas, those parcels which are offered to migrants. While it is uncertain exactly how many of the 1,393 people who migrated into Opuwo in the period between 2001 and 2011 took up crop cultivation upon their arrival in the city, it is reasonable to assume that a proportion of these folks implement UPA as a coping mechanism against economic hardship, and thus have contributed significantly to the expansion of cropping activities around in and around Opuwo.

Economic Responses

Turning to economic responses to resource pressures, a notable instance of technological advancements occurred in the mid-20th century with the state-sponsored borehole drilling operations. The opening of new water points led to both extensification and intensification of pastoral practices. However, after several decades, much of the rural land was exhausted or occupied, and profitable opportunities dwindled, which in effect led to a demographic response where rural populations began migrating to urban areas. It can be posited that the movement towards cities brought with it its own extensification, in that areas that were not used for agriculture before, were opened up for farming, in effect the creation of UPA.

Focusing briefly on the economic response of intensification, Boserup (1965) asserts that there are five phases of land use through which a community transitions as population pressures escalate, employing increasingly intensive agricultural methods in order to boost production (p.15-16). Bilsborrow (1987) fleshes out this concept, integrating nomadic grazing into the model, demonstrating that the transition from pastoralist activities to cropping is an intensification type of economic response (p.188). Greiner and Mwaka (2016) apply these theories through a case study from a marginal dryland context in Kenya, assessing the dynamics behind a community's shift from nomadic pastoralism towards more sedentary cropping activities. They define the difference between diversification (a term which is often cited as a driver behind UPA participation), and intensification. Where diversification tends to imply off-farm employment and may be used temporarily and on a small-scale to mitigate risk, intensification refers to longer term transformations in which a parcel of land's productivity is increased by changing how the land is used and investing more inputs.

Taking this theoretical background into consideration in the case of Opuwo's expansion of UPA, I argue that both intensification as well as diversification are at play, and farmers lie on a

graduated scale, rather than fitting into one category or the other. For example, newer migrant farmers may stand more the diversification side of the scale, as they are employing potentially temporary measures of food production in response to economically insecure times. The farmers who have been cropping longer may lie more on the intensification side, as many have shifted from pastoralist activities, and integrated cropping into their long-term livelihood strategy, and can afford to expend more on inputs such as labor and tractor hire.

In conclusion, this section defined the concept of demographic transition, which Namibia is currently experiencing, and the relation between population growth, its resulting resource pressure, and various responses a community employs to relieve this pressure, be it demographic or economic. I argue that the expansion of UPA is, in part, a by-product of such responses to population pressure. The demographic response of migration has changed the face of Opuwo in past decades, contributing 54% to the population growth between 2001 – 2011 alone. Newcomers seek means of food security through self-subsistence cropping, and are given the least desired land furthest from water sources, in effect continually extending the fringes of UPA outward. An economic response to population pressure is demonstrated by the shift from pastoralism towards more intensive land use methods, i.e. crop cultivation, and can be driven both by motivations to intensify and to diversify. Thus, the expansion of UPA cultivation is likely an indirect consequence of increasing population, urbanization, and resource pressures.

5.3.2 Socio-Economic

As outlined in the literature review, many studies on UPA in Africa focus on socio-economic impacts of UPA activities at the household level. Participation in UPA can be a response to changes in the urban environment, and may also reflect the adapting financial needs of urban households (Thornton, 2008). Unemployment, poverty, and food insecurity in rapidly urbanizing contexts, as well as larger economic crises, motivate people to become urban farmers. Although poverty has declined in the past 20 years in Namibia, inequality and unemployment, especially in the urban context, still overshadow the nation's economic situation (IOM, 2016, p.viii), and Opuwo is no exception, which points to another force behind UPA growth.

Looking into the proportion that food expenses consume from a household's income may provide evidence for the economic significance that UPA has for a family. Farmers come from a wide range of socio-economic backgrounds. On the lower-income end, Namibians over the age of 60 are entitled to receive the old-age pension grant, which amounts to N$ 1,100 per month (Wiman, Helenius, & Masabane., 2016, p.1). Those who farm full-time earn N$ 2,252 on average (NSA, 2017b, p.50). On the other end of the spectrum, working in the public sector

or in education, a person can earn N$ 11,394 and N$ 14,619 respectively (NSA, 2017b, p.50). The social obligation that a family carries to act as an informal safety net for family members in need carves out a portion of the monthly income, which is often sent to children in school or to struggling relatives in the city (Wiman et al., 2016), as was also uncovered in our interviews. With the understanding that the average person in Namibia consumes 44 kg maize meal annually, and considering that the average number of people a farming household must provide for is 11.5 persons according to our survey, it can be deduced that a household is responsible to provide approximately 506 kg maize meal per year to feed their family, or 42.2 kg per month. Bringing in price figures from the market survey, it would cost a family N$ 315 per month to supply their household members with 45 kg of the cheapest brand, “Number One” maize meal. The more expensive brands would run a family N$ 472.05 for a 45 kg sack of “Namib Sun” or N$ 562.70 for 50 kg of “Top Score”. For a pensioner, the low-cost brand would use up almost a third of their grant money. The cost carries less of a burden for full-time farmers, and likely poses no financial concern for those with higher-paid salaried jobs. For farmers with a low income, particularly pension grant recipients, any food that they grow themselves, instead of purchasing, would substantially help their economic situation. As UPA farmers in Opuwo come from diverse socio-economic backgrounds, it can be concluded that income level and poverty play a role in UPA participation for the low-income farmers, however it is not the only factor explaining the expansion of crop cultivation.

The move towards cropping over the past decades may also be a coping strategy against economic challenges which have arisen in the livestock sector. With a rising population, degrading pastureland, and increasing competition, land shortage in communal areas has become a real issue connected to poverty (Pankhurst, 1995). The ability to keep large numbers of cattle as a main source of income has become more and more precarious. For example, the wealthiest 8% of farmers are the only population segment that can afford to maintain herds of 200 heads of cattle or more, whereas 20 animals or less are the norm for approximately half of the Kunene cattle farmers (Schnegg, 2015, p.208). With less opportunity to make a living from pastoralism, cattle farmers must attune themselves to a wider array of economic opportunities that can promise more secure income streams, which often means salaried employment in the city, thus triggering out-migration, whether into the regional capital of Opuwo (as discussed in the previous section) or further to the national capital of Windhoek. A study conducted in Windhoek found that 85% of the people living in informal settlements migrated from their homes in the north, and 65% came in search of employment, many of which were youth who had a low education level and little income (NSA, 2015b, p.iv). Indeed, a crucial survival tactic for poor urban migrants is that of food transfers from their relatives who stayed behind on the farm.

Frayne (2007) found that 62% of urban migrants, the majority of which came from the north to Windhoek, depended on their social connections back home to ensure their food security, and while less remittances were flowing back to the rural areas, more pressure was placed on the farming family members to support their urban kin (p.97). Net permanent out-migration from the greater Opuwo constituency numbered 2,173 people, or -7.4% of the total population, in 2011 (NSA, 2015b, p.28). Some of these migrants represent those who rely on the social safety net of their relatives who remained at the farming homestead, be it on rural farms or UPA farms. This both reinforces demand for a household's harvest, and can also place pressure on a farmer to expand cropping operations and boost yields. Thus, the requirement to fulfill kinship obligations may also be a factor in the expansion of UPA.

In order for UPA farmers in Opuwo to increase their yields, they would have to drastically increase investment in inputs, infrastructure, and labor. This ambition was apparent only in the two entrepreneurial case study farmers, who serve as examples of rising commercial family farms. They have income stability and available capital from their own private earnings to invest into operations, taking on financial burdens in the hope that they will reap rewards in the future. However, the lack of investment from the general farming population comes as no surprise, considering the unpredictable economic and environmental climate of Namibia, insecure land tenure, and modest incomes. Uncertainty checks farmers' eagerness to make large long-term investments (Hillyer, McDonagh, & Verlinden, 2006). Should farmers be interested in expanding their operations, obtaining additional capital is a challenge, as was mentioned by farmers in this survey. The primary credit institution is Agribank, and while it provides subsidized loans to farmers in the Green Schemes, independent farmers are not eligible to receive subsidies and communal lands cannot be used as collateral. Although financing is necessary to foster a prosperous agricultural sector, the situation is unlikely to change, as farmers often don't know what options are available to them, and banks tend to see small-scale farmers as risky and unprofitable business ventures (Amadhila & Ikhide, 2016). Yet, even public investment strategies have not proven to be necessarily profitable to its beneficiaries. Local land reform instruments which allot small parcels of land to low income farmers has resulted in mixed results, turning out in some cases to be more a detriment than advantage (Lohmann, Falk, Geissler, Blaum, & Jeltsch, 2014). The Green Scheme project and its accompanying private family farmers are a good example of how government support may not significantly affect agricultural output. A report from Fiebiger et al. (2010) found that private farmers outside the schemes proved able to use the tools at their disposal to participate in the local food economy, often competing on par with Green Scheme beneficiaries. However, the farmers in

that study had a promising market for their fresh produce, predicted to increase by 60% in the coming years, not to mention a secure source of irrigation water (Fiebiger et al., 2010, p.23).
In summary, in the case of UPA in Opuwo, financing options and market opportunities have not been instrumental in promoting the growth of UPA. Rather, maintaining low costs of production have been crucial for the execution of UPA around Opuwo, as it allows farmers to practice cultivation without the risk of great losses should their crops fail. In a year of good yields, farmers benefit from nutritional supplement throughout the year, economically by saving money on food purchases and participating in the barter system, as well as socially by supporting their familial safety net and thus fulfilling social obligations.

5.3.3 Environmental

Although environmental factors have been touched on throughout this thesis, its momentous impact on the agricultural sector warrants it further attention.
Namibia, being a predominantly arid country, is exceptionally vulnerable in the face of climate change. Average temperatures are forecasted to increase between 2 and 6 degrees Celsius by the end of the century (Government of Namibia, 2002, p.35), and extreme weather events such as flooding and drought are only expected to increase, wreaking havoc on the country's natural resources and national economy, translating to an estimated 40 - 80% drop in agricultural production and an annual 5% loss to the GDP over 20 years (Reid, Sahlen, Stage, & MacGregor, 2008, p.452 & 459). Drought is of utmost concern for the northwest region, and is cited as the number one natural disaster to affect the agricultural sector (NSA, 2015a, p.50). The 2013 / 2014 drought, which stretched across northern Namibia and southern Angola, was recorded as the worst drought in 30 years, plunging millions of people into food scarcity and prompting a wave of cross-border migrations from Angola into Namibia of people in search of food and medical care (Gjerstad, 2014).
Anticipating these climatic changes, the agricultural sector will have to brace itself for a blow, and subsistence farmers who cultivate or graze their herds on marginal rain-fed lands will be hit particularly hard. One study predicted that non-irrigated subsistence farming could die out completely in some regions of Namibia, destroying the livelihoods of those who depend on it (Reid et al., 2008, p.459), which is particularly ominous for many of Opuwo's UPA farmers.
Further exacerbating this precarious situation is land degradation which has been deteriorating the productivity of the land for the past half century (Lange, Barnes, & Motinga, 1998). As mentioned in chapter two, this is in part a result of the borehole drilling operations which largely demolished the transhumance cycle and reshaped the landscape. In the absence of the perennial grasses, woody leguminous plants have taken root, predominantly the butterfly-

leafed *Colophospermum mopane* in the northwest. It is estimated that bush encroachment has thus far overtaken 26 million ha of Namibia's savannahs (de Klerk, 2004, p.191), and by the year 2080 desert and arid shrub-land will prevail over other land types (Midgley, Hughes, Thuiller, Drew, & Foden, 2005, p.3). Further, in lieu of the perennial grasses which previously bound the soil securely together and channeled rainwater into the deeper layers of the water table, bare soils remain, which are rapidly washed away with the rains, leaving deep cuts in the earth as was seen in our field study.

Pastoralists in northwest Namibia have historically demonstrated intimate and in-depth agro-ecological knowledge in terms of livestock management and grazing vegetation, documented by Bollig and Schulte (1999), and have dealt with environmental challenges by adjusting grazing patterns, for example, by lowering stocking densities in times of low precipitation and enlarging herds after good rainy seasons (Burke, 2004; Lange et al., 1998). This agro-ecological knowledge base allows farmers to adapt their activities to the unpredictable climate in which they live, and in turn provides flexibility and resiliency in the face of climate change (Newsham & Thomas, 2011). However, the increasing uptake of crop cultivation may be an indicator that, despite such knowledge and experience in dealing with uncertain environmental conditions, the challenges involved with pastoralism have become too great that farmers must explore alternative livelihoods, such as UPA.

The MoAWF posited that a main reason former full-time pastoralists opted to try their hand at cultivation is water scarcity. One benefit of cultivating crops over livestock is the degree of control that a farmer can exercise. Where livestock farming requires a dependable source of water year-round, planting follows the rainy seasons. Seeds don't go into the ground until after the rains have begun. With erratic rainfall and the rainy season continually shifting, farmers can react accordingly and adjust their planting patterns. Further, while the main crop of maize is certainly vulnerable to dry conditions, short-cycle and drought-resistant hybrid seed varieties are increasingly available, which can additionally assist to mitigate potential risks. Still, crops rely on precipitation during particular growing phases, and even a dry season that is not officially considered a meteorological drought can lead to agricultural drought (Angombe, 2012). The susceptibility of crops to desiccation in dry months can vary widely based on the location of the parcel, even within the same region. This was notable through the farmer surveys as well. Farmers interviewed whose parcel lay closer to ephemeral streams expressed less concern for water shortages than those on dryland parcels. One farmer who farmed on a rain-fed parcel lost her entire harvest last year due to low precipitation. With much of the arable land surrounding ephemeral streams already occupied, and irrigation not being a widespread practice, the outward expansion of crop cultivation around Opuwo is bounded.

The government of Namibia has recognized water scarcity as the greatest challenge and limiting factor in securing adequate food production, and in turn national food security (NSA, 2015a; Shifiona et al., 2016). Such threats have instigated state investments in mitigation and security measures, including initiating the Green Scheme irrigation projects, building national grain storage facilities, and encouraging local production through institutionalization of land deeds; efforts which have met criticism for their lack of effectiveness (Froystad et al., 2009). Irrigation, for example, is practiced on a miniscule scale in Namibia. As of 2011, a mere 906 households in the entire country irrigated (NSA, 2015a, p.38). To secure a water source for irrigation around Opuwo would require purchasing water from NamWater or drilling a private borehole, and as both options are out of the price range for the majority of Opuwo's farmers, irrigation is an unlikely solution to water scarcity.

Another potential strategy to approach water insecurity, specifically in urban areas, is to use treated wastewater for irrigation. One study in the north-central Namibian town Outapi found that introducing wastewater reuse infrastructure could increase water productivity (Woltersdorf, Liehr, Scheidegger, & Döll, 2015). While this kind of technology could make new resources available, it would require coordinated efforts and funds to ensure that wastewater exiting the system is free of toxins and pathogens, and safe to use on food crops (Maheshwari & Bristow, 2016). Further, soil erosion and use of agro-chemicals can also present health risks and environmental damages if UPA is not well managed (Stewart et al., 2013).

Additionally, the decision to invest in agricultural infrastructure must be balanced against future competing demands for water resources and other land uses. Land use change tends to follow a path where uninhabited natural areas, such as forests or wetlands, are replaced by agricultural land, which in turn is replaced by urban areas, precipitated by population growth, infrastructural developments, and economic opportunities. Urban spaces often expand at the expense of productive cultivated areas (Lambin et al., 2001). This is a particular concern on the African continent, which is projected to undergo the highest percentage of production loss on account of urban sprawl in the coming decades, relative to other regions (Bren d'Amour et al., 2016). UPA farmers stand at the interface of this process, and may end up getting the short end of the stick as urbanization progresses (McGregor, Adam-Bradford, Thompson, & Simon, 2011). High population pressures in urban centers and low land values on the periphery can induce development of previously arable land for more profitable residential or business uses, in effect either squeezing small-scale UPA farmers out or enticing them to abandon their posts for more lucrative and secure livings, as seen in case studies from Ghana and Lesotho (Cobbinah, Gaisie, & Owusu-Amponsah, 2015; Thebe & Rakotje, 2013).

This could prove to be the case in Opuwo as the small town hurtles down the path of urbanization towards a more metropolitan future. This case study provides a snapshot in time of a city in transition. The expansion of UPA may simply be a temporary intervention of people facing exacting demographic, socio-economic, and environmental times, but whether UPA will be a long-term permanent feature in Opuwo's landscape stands to be seen. Should local authorities identify urban and peri-urban agriculture as a priority area to support through, for example, trainings, subsidies, local market integration, or urban wastewater irrigation schemes, or should financial opportunities prove attractive enough to persuade local agro-businesses to invest, perhaps crop cultivation may become an enduring component of Opuwo's urban and peri-urban landscape. Be that as it may, it is not the intention of this thesis to assert a normative statement on the future development of UPA in Opuwo, but only to explore the reasons behind its proliferation.

In conclusion, I argue that environmental aspects play a primary role in the expansion of UPA, while simultaneously limiting it. The changing climate and degrading natural resources have placed increasing pressure on pastoralist activities, in effect making it a less secure means of livelihood, thus impelling livestock farmers to explore alternative economic activities to support their households, such as crop cultivation or, as mentioned in previous sections, urban employment. Still, cultivation is vulnerable to climatic variability and water scarcity and irrigation is not widespread, which in effect restricts the expansion of UPA activities. Further, the demand for water and land resources to serve the growing urban population of Opuwo may outcompete the needs of UPA.

On a final note, as outlined in the introduction of this thesis, UPA can be a solution to various negative effects that the farming industry inflicts upon the global environment. While UPA farmers in Opuwo may reap environmental benefits and bestow positive impacts upon the world by producing food locally, farmers' decision to participate in UPA cultivation was most likely not influenced by global concerns for GHG emissions or local green spaces. Rather, farmers are reacting to local environmental circumstances, combined with other factors, such as population pressures, economic opportunities and social obligations.

5.4 Limitations and Future Research

This thesis serves as a case study which may contribute to the growing body of literature focused on the expansion of UPA in rapidly urbanizing small cities in sub-Saharan Africa. It is worth noting that various limitations, including logistical (e.g. transportation and translation services), financial, and time spent in the field, influenced the sample size as well as sampling techniques, specifically the use of the snowball method for selecting respondents, which has

been criticized for being a biased sampling method (Erickson, 1979, p.279 & 281). This study could benefit from an increased sample size to uncover trends which may be representative of the wider population.

Future studies could focus on quantification of data, such as yields, household food expenditures, as well as monetary savings from own production, although this type of data can be difficult to collect, as households are generally not in the habit of monitoring and recording such things (Thornton, 2008, p.253). Additionally, the influence of other income sources on a farmers' decision to participate in UPA could be explored in further detail. Further, migration patterns of UPA farmers and motivations behind migration may provide interesting insight into factors influencing cropping, especially for new farmers. Finally, from the consumption side, market assessments should be conducted over an extended duration in order to capture a comprehensive picture of changing market trends (Martin et al., 2001, p.16).

From the environmental perspective, although UPA can contribute to maintaining natural resource bases and supporting ecosystem services, thus making a city more sustainable (Maheshwari & Bristow, 2016), it can also have potential negative impacts such as pollution, erosion, or unwise use of scarce water resources (Fiebiger et al., 2010, p.v), all of which are areas of further exploration.

Finally, land use classification and analysis using remotely sensed data over a multi-decadal time frame would add depth and new insights to the locations of expansion and intensification of cultivation activities, particularly in relation to water sources, transportation infrastructure, and urban areas, as seen in the studies by Welle and Franke (2006) and Wingate et al. (2016).

Considering that there is no single and correct answer to the study's research question, this thesis is exploratory in nature and the findings presented herein endeavoured to provide a basic foundational understanding of UPA in the region rather than to assert conclusive results.

Chapter Six: Conclusion

Recognizing that crop cultivation in urban and peri-urban areas of Opuwo has been increasing in recent decades, this thesis aimed to identify the factors which are driving that expansion. The main drivers for UPA crop expansion that emerged from this study include: environmental stressors, population pressure and urban migration; economic savings and dietary supplement; and supporting the informal social safety net. However, the motivations for farmers to move into crop cultivation are varied and interconnected. Environmental degradation and climate change have created increasingly precarious circumstances for pastoralist livelihoods, which is intensified by population growth and resource pressures. This in turn triggers migration into the city in search for more secure income streams. Newly arrived migrants are often granted marginal lands on which they cultivate crops to supplement their livelihoods. On the other side, out-migration from farming homesteads to large cities such as Windhoek, creates social obligations in which families are responsible for transferring part of their yield to urban-based relatives in need, thus reinforcing demand for a farmer's harvests. Most farmers participate in UPA to supplement household food supply, reducing income required to expend on food purchases, and mediating risks in economically and environmentally uncertain times, which is particularly important for low-income farmers and pensioners. While most farmers do not produce for market, crops are used as capital for barter and trade in the informal economy.

The entrepreneurial farmers are noteworthy exceptions in their efforts to commercialize cultivation, made possible by their personal investments in infrastructure and growing specialty crops. Their entry into the formal market retail chain, which is increasingly international, may prove a challenge or opportunity for their growing agro-businesses. Although the future of UPA in Opuwo appears to be continuing to expand, it is reasonable to suspect that cropping will remain a small-scale activity, considering the precarious status of water supplies in northwestern Namibia, as opposed to moving towards commercialization, save for the entrepreneurial spirits.

References

Abdalla, I.F., (2012). *Socioeconomic aspects of urban and peri-urban agriculture: A diagnostic study in Khartoum, Sudan* (Doctoral dissertation). Kassel, Germany: Kassel University Press. Retrieved from http://nbn-resolving.de/urn:nbn:de:0002-32698

Adedeji, O.H., & Ademiluyi, I.A. (2009). Urban agriculture and urban land use planning: Need for a synthesis in metropolitan Lagos, Nigeria. *Journal of Geography and Regional Planning, 2*(3), 043-050. http://www.academicjournals.org/JGRP ISSN 2070-1845

Akey, M.L., & Magloire, T.M.B. (2012). A socio-economic and environmental analysis of peri-urban agricultural activities in the Yaounde-Nsimalen area. *Africana Studia, 19*, 141-156.

Amadhila, E., & Ikhide, S. (2016). Unfulfilled loan demand among agro SMEs in Namibia. *South African Journal of Economic and Management Sciences, 19*(2), 282-301. http://dx.doi.org/10.17159/2222-3436/2016/v19n2a8

Angombe, S.T. (2012). Evaluation of drought indices using the 40-percentile threshold for the north-central regions of Namibia. *Journal for Studies in Humanities and Social Sciences 1*(2), 247-260.

Ayerakwa, H.M. (2017). Urban households' engagement in agriculture: Implications for household food security in Ghana's medium sized cities. *Geographical Research, 55*(2), 217-230. doi:10.1111/1745-5871.12205

Bellarby, J., Foereid, B., Hastings, A., & Smith, P. (2008). *Cool Farming: Climate Impacts of Agriculture and Mitigation Potential.* Amsterdam, Netherlands: Greenpeace International. Retrieved from http://hdl.handle.net/2164/2205

Bilsborrow, R.E. (1987). Population pressures, and agricultural development in developing countries: A conceptual framework and recent evidence. *World Development, 15*(2), 183-203.

Bollig, M., & Schulte, A. (1999). Environmental change and pastoral perceptions: Degradation and indigenous knowledge in two African pastoral communities. *Human Ecology, 27*, 493–514. https://doi.org/10.1023/A:1018783725398

Bollig, M. (2006). *Risk management in a hazardous environment: A comparative study of two pastoral societies*. New York, NY: Springer.

Bollig, M. (2013). Social-ecological change and institutional development in a pastoral community in north-western Namibia. In Bollig, M., Schnegg, M., & Wotzka, H.P., (Eds.), *Pastoralism in Africa: Past, Present and Future* (pp. 316–340). Oxford/New York: Berghahn.

Boserup, E. (1965). *The conditions of agricultural growth*. London: Allen and Unwin.

Boserup, E. (1981). *Population and technological change*. Chicago, IL: University of Chicago Press.

Bren d'Amour, C., Reitsma, F., Baiocchi, G., Barthel, S. Güneralp, B., Erb, K-H., …Seto K.C. (2017). Future urban land expansion and implications for global croplands. *Proceedings of the National Academy of Sciences, 114*(34), 8939-8944. doi:10.1073/pnas.1606036114

Brook, R.M., & Davila, J.D. (2000). *The peri-urban interface: A tale of two cities.* London: University College London.

Burke, A. (2004). Range management systems in arid Namibia—What can livestock numbers tell us? *Journal of Arid Environments*, *59*, 387–408. doi:10.1016/j.jaridenv.2004.01.019

Caldwell, J.C. (2004). Demographic theory: A long view. *Population and Development Review, 30,* 297-316. doi:10.1111/j.1728-4457.2004.014_1.x

Castillo, G. (2003). Livelihoods and the city: an overview of the emergence of agriculture in urban spaces. *Progress in Development Studies, 3*(4), 339-344. doi:10.1191/1464993403ps069pr

Chandon, P., & Wansink, B. (2012). Does food marketing need to make us fat? A review and solutions. *Nutrition Reviews, 70*(10), 571–593. https://doi.org/10.1111/j.1753-4887.2012.00518.x

Cobbinah, P.B., & Amoako, C. (2012). Urban sprawl and the loss of peri-urban land in Kumasi-Ghana. *International Journal of Social and Human Sciences, 6,* 388-397.

Cobbinah, P.B., Gaisie, E., & Owusu-Amponsah, L., (2015). Peri-urban morphology and indigenous livelihoods in Ghana. *Habitat International*, *50*, 120-129. http://dx.doi.org/10.1016/j.habitatint.2015.08.002

D'Hease, M., & Van Huylenbroeck, G. (2005). The rise of supermarkets and changing expenditure patterns of poor rural households: A case study in the Transkei area, South Africa. *Food Policy*, *30*, 97-113. doi:10.1016/j.foodpol.2005.01.001

de Bon, H., Parrot, L., Moustier, P. (2010). Sustainable urban agriculture in developing countries. A review. *Agronomy for Sustainable Development*, *30*(1), 21-32. doi:10.1051/agro:2008062

de Klerk J. (2004). *Bush encroachment in Namibia.* Windhoek, Namibia: John Meinert Publishing.

de Zeeuw, H. & Dubbeling, M. (2009). *Cities, food and agriculture: Challenges and the way forward*. Working Paper No. 3. Leusden: RUAF Foundation. Retrieved from http://www.ruaf.org/sites/default/files/Working%20paper%203%20%20Cities%20Food%20and%20Agriculture.pdf

Dobson, P.W., Waterson, M., & Davies, S.W. (2003). The patterns and implications of increasing concentration in European food retailing. *Journal of Agricultural Economics, 54*(1),111-125. https://doi.org/10.1111/j.1477-9552.2003.tb00053.x

Dossa, L.H., Buerkert A., & Schlecht, E. (2011). Cross-location analysis of the impact of household socioeconomic status on participation in urban and peri-urban agriculture in west Africa. *Human Ecology, 39*(5), 569-581. doi:10.1007/s 10745-0 11 -9421 -z

Dyson, T. (2011). The role of the demographic transition in the process of urbanization. *Population and Development Review, 37*, 34–54. doi:10.1111/j.1728-4457.2011.00377.x

Emongor, R., & Kirsten, J., (2009). The impact of South African supermarkets on agricultural development in the SADC: A case study in Zambia, Namibia and Botswana *Agrekon, 48*(1), 60-84.

Erickson, B.H. (1979). Some problems of inference from chain data. *Sociological Methodology, 10*, 276-302. Retrieved from http://www.jstor.org/stable/270774

Falk, T. (2008). *Communal farmers' natural resource use and biodiversity preservation: A new institutional economic analysis from case studies in Namibia and South Africa.* Göttingen, Germany: Cuvillier Publishers.

Falk, T., Kirk, M., Lohmann, D., Kruger, B., Hüttich, C., & Kamukuenjandje, R. (2017). The profits of excludability and transferability in redistributive land reform in central Namibia. *Development Southern Africa, 34*(3), 314-329. doi:10.1080/0376835X.2016.1269633

FAO (Food and Agriculture Organization of the United Nations). (2012). *Growing greener cities in Africa: first status report on urban and peri-urban horticulture in Africa.* Rome, Italy: United Nations Food and Agriculture Organization. Retrieved from http://www.fao.org/docrep/016/i3002e/i3002e.pdf

Fiebiger, M., Behmanesh, S., Dreuße, M., Huhn, N., Schnabel, S., & Weber, A. K. (2010). *The small-scale irrigation farming sector in the communal areas of Northern Namibia – An assessment of constraints and potential*. SLE Publication Series 242. Windhoek/Berlin: Seminar für Ländliche Entwicklung. Retrieved from https://edoc.hu-berlin.de/bitstream/handle/18452/3839/242.pdf?sequence=1

Foley, J.A., DeFries, R., Asner, G.P., Barford, C., Bonan, G., Carpenter, S.R., … Snyder, P.K. (2005). Global consequences of land use. *Science 309*(5734), 570–574. doi:10.1126/science.1111772

Frayne, B. (2007). Migration and the changing social economy of Windhoek, Namibia. *Development Southern Africa, 24*(1), 91-108. doi:10.1080=03768350601165918

Froystad, M., Hoffmann, J., & Schade, K. (2009). *Agriculture: Future scenarios for southern Africa – Country briefing – Namibia.* Winnipeg, Canada: International Institute for Sustainable Development. Retrieved from http://www.iisd.org/sites/default/files/publications/ag_scenarios_south_africa_namibia.pdf

Garnett, T. (2011). Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)? *Food Policy, 36,* S23–S32. http://doi.org/10.1016/j.foodpol.2010.10.010

Geist, H.J., & Lambin, E.F. (2004). Dynamic causal patterns of desertification. *BioScience*, *54*(9), 817–829. https://doi.org/10.1641/0006-3568(2004)054[0817:DCPOD]2.0.CO;2

Gerster-Bentaya, M. (2013) Nutrition-sensitive urban agriculture. *Food Security, 5,* 723–737 doi: 10.1007/s12571-013-0295-3

Giller, K.E., Witter, E., Corbeels, M., & Tittonell, P. (2009). Conservation agriculture and smallholder farming in Africa: The heretics' view. *Field Crops Research, 114*, 23–34. doi:10.1016/j.fcr.2009.06.017

Gjerstad, R. (2014). Angola's Migration of Thirst: the 2013 Drought. In Gemenne, F., Brücker, P. & Ionesco, D., (Eds.), *The State of Environmental Migration 2014: A Review of 2013*. (pp. 85-99). IOM, COST. Retrieved from https://www.iom.int/files/live/sites/iom/files/What-We-Do/docs/SEM2015-29dec.pdf

Government of Namibia. (2002). *Initial National Communication to the United Nations Framework Convention on Climate Change*. Retrieved from http://unfccc.int/resource/docs/natc/namnc1.pdf

Greiner, C., & Mwaka, I. (2016). Agricultural change at the margins: Adaptation and intensification in a Kenyan dryland. *Journal of Eastern African Studies, 10*(1), 130-149. doi:10.1080/17531055.2015.1134488

Hillyer, A.E.M., McDonagh, J.F., & Verlinden, A. (2006). Land-use and legumes in Northern Namibia—The value of a local classification system. *Agriculture, Ecosystems and Environment, 117,* 251–265. doi:10.1016/j.agee.2006.04.008

Hoekstra, A.Y., & Mekonnen, M.M. (2012). The water footprint of humanity. *Proceedings of the National Academy of Sciences, 109*(9), 3232-3237. www.pnas.org/cgi/doi/10.1073/pnas.1109936109

Horsthemke, O. (2009). Namibian trade directory 2009: Agriculture: Unlocking our true potential – An engine for growth in the Namibian economy. *A review of Namibian trade and industry, 18.*

Humavindu, M.N., & Stage, J. (2013). Key sectors of the Namibian economy. *Journal of Economic Structures, 2*(1), 1-15. https://doi.org/10.1186/2193-2409-2-1

IOM (International Organization for Migration). (2016). *Migration in Namibia: A country profile 2015.* [Prepared by Marius Olivier] Switzerland: IOM. Retrieved from https://nsa.org.na/page/publications/

IPCC (Intergovernmental Panel on Climate Change). (2007). *Contribution of working group III to the fourth assessment report of the Intergovernmental Panel on Climate Change, 2007.* [edited by B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer] Cambridge, UK, and New York, NY, USA: Cambridge University Press.

IPCC (Intergovernmental Panel on Climate Change). (2014). *Climate change 2014: Synthesis report. Contribution of working groups I, II and III to the fifth assessment report of the Intergovernmental Panel on Climate Change* [Core Writing Team: R.K. Pachauri and L.A. Meyer (Eds.)]. Geneva, Switzerland: IPCC.

Jacobson, P.J., Jacobson, K.M., & Seely, M.K. (1995). *Ephemeral rivers and their catchments: Sustaining people and development in western Namibia.* Windhoek, Namibia: Desert Research Foundation of Namibia.

Kirk, D. (1996). Demographic transition theory. *Population Studies, 50*, 361-387.
Lambin, E.F., Turner, B.L., Geist, H.J., Agbola, S.B., Angelsen, A., Bruce, J.W., …Xu, J. (2001). The causes of land-use and land-cover change: Moving beyond the myths. *Global Environmental Change*, *11*, 261-269.
Lange, G-M., Barnes, J., & Motinga, D. (1998). Cattle numbers, biomass, productivity and land degradation in the commercial farming sector of Namibia, 1915 – 1995. *Development Southern Africa, 15*(4), 555-572.
Lin, B.B., Philpott, S.M., & Jha, S. (2015). The future of urban agriculture and biodiversity-ecosystem services: Challenges and next steps. *Basic and Applied Ecology, 16*, 189–201. http://dx.doi.org/10.1016/j.baae.2015.01.005
Lohmann, D., Falk, T., Geissler, K., Blaum, N., & Jeltsch, F. (2014). Determinants of semi-arid rangeland management in a land reform setting in Namibia. *Journal of Arid Environments, 100-101*, 23-30. http://dx.doi.org/10.1016/j.jaridenv.2013.10.005
Low, A., Akwenye, P., & Kamwi, K. (1999). Small-family farm types: Examples from Northern Namibia and implications for agrarian reform in South Africa. *Development Southern Africa, 16*(2), 335-344.
Maheshwari, B., & Bristow K.L. (2016). Peri-urban water, agriculture and urbanisation. *Agricultural Water Management, 176*, 263–265. http://dx.doi.org/10.1016/j.agwat.2016.09.009
Martin, A., Oudwater, N., & Gündel, S. (2002). *Methodologies for situation analysis in urban agriculture* (Paper presented at e-Conference on Appropriate Methodologies for Urban Agriculture: Research, Policy Development, Planning Implementation and Evaluation, 4-16 February ETC-Netherlands). Retrieved from https://www.ruaf.org/sites/default/files/discussionpaper%201%20situation%20analysis%20%281%29.pdf
McCann, J.C. (2005). *Maize and grace: Africa's encounter with a new world crop, 1500–2000.* Cambridge, MA: Harvard University Press.
McGregor, D.F.M., Adam-Bradford, A., Thompson, D.A., & Simon, D. (2011). Resource management and agriculture in the peri-urban interface of Kumasi, Ghana: Problems and prospects. *Singapore Journal of Tropical Geography, 32,* 382-398. doi:10.1111/j.1467-9493.2011.00438.x
Mendelsohn, J. (2006) *Farming systems in Namibia.* Windhoek, Namibia: Research & Information Services of Namibia (RAISON).
Midgley, G., Hughes, G., Thuiller, W., Drew, G., & Foden, W. (2005). *Assessment of potential climate change impacts on Namibia's floristic diversity, ecosystem structure and function.* Cape Town, South Africa: South African National Biodiversity Institute. Retrieved from https://www.sanbi.org/sites/default/files/documents/documents/midgley-et-al-2005-namibian-ecological-impacts-climate-change-report-final-14-apr-05.pdf
Newsham, A., & Thomas, D. (2011). Knowing, farming and climate change adaptation in North-Central Namibia. *Global Environmental Change, 21*, 761-770. doi:10.1016/j.gloenvcha.2010.12.003
NSA (Namibia Statistics Agency). (2003). *2001 Population and housing census: Main report.* Retrieved from https://nsa.org.na/page/publications/
NSA (Namibia Statistics Agency). (2004). *2001 Population and housing census: Kunene regional profile.* Retrieved from https://nsa.org.na/page/publications/
NSA (Namibia Statistics Agency). (2013). *2011 Population and housing census: Main report.* Retrieved from https://nsa.org.na/page/publications/
NSA (Namibia Statistics Agency). (2014a). *2011 Population and housing census: Kunene regional profile.* Retrieved from https://nsa.org.na/page/publications/

NSA (Namibia Statistics Agency). (2014b). *2011 Population and housing census: Kunene regional tables based on 4th delimitation*. Retrieved from https://nsa.org.na/page/publications/

NSA (Namibia Statistics Agency). (2014c). *Namibia population projections (2011-2041).* Retrieved from https://nsa.org.na/page/publications/

NSA (Namibia Statistics Agency). (2015a). *Namibia census of agriculture 2013/2014: Communal sector report.* Retrieved from https://nsa.org.na/page/publications/

NSA (Namibia Statistics Agency). (2015b). *Namibia 2011 census: Migration report.* Retrieved from https://nsa.org.na/page/publications/

NSA (Namibia Statistics Agency). (2017a). *Namibia consumer price index: January 2017.* Retrieved from: https://cms.my.na/assets/documents/NCPI_-_January_2017.pdf

NSA (Namibia Statistics Agency). (2017b). *The Namibia labor force survey 2016 report.* Retrieved from https://nsa.org.na/page/publications/

Obudho, R.A., & Foeken, D.W.J. (1999). *Urban agriculture in Africa: A bibliographical survey.* Research Report, 58. Leiden, Netherlands: African Studies Centre. Retrieved from http://hdl.handle.net/1887/387

Omondi, S.O., Oluoch-Kosura, W., & Jirstöm, M. (2017). The role of urban-based agriculture on food security: Kenyan case studies. *Geographical Research, 55*(2), 231-241. doi:10.1111/1745-5871.12234

Pankhurst, D. (1995). Towards reconciliation of the land issue in Namibia: Identifying the possible, assessing the probable. *Development and Change, 26,* 551-585.

Pimm, S.L., & Raven, P. (2000). Extinction by numbers. *Nature, 403*, 843-845. doi:10.1038/35002708

Rao, V. (2000). Price heterogeneity and "real" inequality: A case study of prices and poverty in rural south India. *Review of Income and Wealth, 46*(2), 201-211. doi:10.1111/j.1475-4991.2000.tb00955.x

Reid, H., Sahlen, L., Stage, J., & MacGregor, J. (2008). Climate change impacts on Namibia's natural resources and economy. *Climate Policy, 8*, 452-466. doi:10:3763/cpol.2008.0521

Rischke, R., Kimenju, S.C., Klasen, S., & Qaim, M. (2015). Supermarkets and food consumption patterns: The case of small towns in Kenya. *Food Policy, 52*, 9-21. https://doi.org/10.1016/j.foodpol.2015.02.001

Sachs, W. (2010). Environment. In Sachs, W. (Ed.), *The development dictionary: A guide to knowledge as power*, 2nd Edition (pp. 24–37). London & New York: Zed Books.

Satterthwaite, D., McGranahan, G., & Tacoli, C. (2010). Urbanization and its implications for food and farming. *Philosophical Transactions of the Royal Society B: Biological Sciences, 365*(1554), 2809–2820. http://doi.org/10.1098/rstb.2010.0136

Sharma, A.K. (1979). Demographic transition: A determinant of urbanization. *Social Change, 9*(3), 13-17.

Shifiona, T.K., Dongyang, W. & Zhiguan, H. (2016). Analysis of Namibian main grain crops annual production, consumption and trade—Maize and pearl millet. *Journal of Agricultural Science, 8*(3), 70-77. doi:10.5539/jas.v8n3p70

Shiimi, T., Taljaard, P.R. & Jordaan, H. (2012). Transaction costs and cattle farmers' choice of marketing channel in North-Central Namibia. *Agrekon, 51*(1), 42-58. doi:10.1080/03031853.2012.649543

Sim, S., Barry, M., Clift, R., & Cowell, S.J. (2007). The relative importance of transport in determining an appropriate sustainability strategy for food sourcing. *International Journal of Life Cycle Assessment, 12*(6), 422–431. http://dx.doi.org/10.1065/lca2006.07.259

Stark, O. (1991). *The migration of labor.* Cambridge/Oxford: Basil Blackwell Ltd.

Stewart, R., Korth, M., Langer, L., Rafferty, S., Rebelo Da Silva, N., & van Rooyen, C. (2013). What are the impacts of urban agriculture programs on food security in low and middle-

income countries? *Environmental Evidence 2*(7), 1-13. http://www.environmentalevidencejournal.org/content/2/1/7

Tacoli, C. (1998). Rural-urban interactions: a guide to the literature. *Environment and Urbanization, 10*(1), 147-166.

Thebe, V., & Rakotje, M.F. (2013). Land strategies and livelihood dynamics in peri-urban communities: Challenges to land and agricultural policy in Lesotho. *African Studies, 72,* 399-415. http://dx.doi.org/10.1080/00020184.2013.851468

Thebo, A.L., Drechsel, P., & Lambin, E.F. (2014). Global assessment of urban and peri-urban agriculture: Irrigated and rainfed croplands. *Environmental Research Letters, 9*, 1-9. doi:10.1088/1748-9326/9/11/114002

Thornton, A. (2008). Beyond the metropolis: Small town case studies of urban and peri-urban agriculture in South Africa. *Urban Forum, 19*, 243–262. doi:10.1007/s12132-008-9036-7

UN DESA (United Nations, Department of Economic and Social Affairs, Population Division). (2008). *World urbanization prospects: The 2007 revision.* Working Paper No. ESA/P/WP/205. New York, NY: United Nations Department of Economic and Social Affairs, Population Division. Retrieved from http://www.un.org/esa/population/publications/wup2007/2007WUP_Highlights_web.pdf

UN DESA (United Nations, Department of Economic and Social Affairs, Population Division). (2014). *World urbanization prospects: The 2014 revision, highlights.* Working Paper No. ST/ESA/SER.A/352. New York, NY: United Nations Department of Economic and Social Affairs, Population Division. Retrieved from https://esa.un.org/unpd/wup/publications/files/wup2014-highlights.pdf

UN DESA (United Nations Department of Economic and Social Affairs, Population Division). (2017). *World population prospects: The 2017 revision, key findings and advance tables.* Working Paper No. ESA/P/WP/248. Retrieved from https://esa.un.org/unpd/wpp/publications/Files/WPP2017_KeyFindings.pdf

United Nations Country Team-Namibia. (2013). *United Nations partnership framework 2014-2018: A partnership for growth, job creation and equity.* Windhoek, Namibia: Office of the United Nations Resident Coordinator. Retrieved from http://na.one.un.org

van Veenhuizen, R. (2006). Introduction: Cities farming for the future. In R. van Veenhuizen (Ed.), *Cities farming for the future: Urban agriculture for green and productive cities* (pp. 1-17). Ottawa, Canada: RUAF Foundation, International Development Research Centre and International Institute of Rural Reconstruction and ETC Urban Agriculture.

Vazhacharickal, P.J. (2014). Urban and peri-urban agricultural migration: An overview from Mumbai Metropolitan Region (MMR), India. *International Journal of Social Science, 3*(3), 347-365. doi:10.5958/2321-5771.2014.00009.X

Verlinden, A., & Kruger, A.S. (2007). Changing grazing systems in central North Namibia. *Land Degradation & Development, 18,* 179–197. https://doi.org/10.1002/ldr.769

Vermeiren, K., Adiyia, B., Loopmans, M., Tumwine, F.R., & Van Rompaey, A. (2013). Will urban farming survive the growth of African cities: A case-study in Kampala (Uganda)? *Land Use Policy, 35,* 40-49. http://dx.doi.org/10.1016/j.landusepol.2013.04.012

Vermeulen, S.J., Campbell, B.M., & Ingram, J.S.I. (2012). Climate change and food systems. *Annual Review of Environment and Resources, 37,* 195-222. doi:10.1146/annurev-environ-020411-130608

Weatherspoon, D., & Reardon, T. (2003). The rise of supermarkets in Africa: Implications for agrifood systems and the rural poor. *Development Policy Review, 21*(3), 333-355.

Welle, T., & Franke, J. (2006). *Remote sensing–based detection of small scale agricultural sites in north western Namibia*. Proceedings of the 2nd Workshop of the EARSeL SIG on Land Use and Land Cover, Center for Remote Sensing of Land Surfaces, Bonn, 28-30 September 2006, (pp. 157-163).

Werner, W. (2015). *25 Years of Land Reform*. ILMI Working Paper No. 1. Integrated Land Management Institute, Polytechnic of Namibia, Windhoek. Retrieved from http://ir.nust.na/handle/10628/585

Wiman, R., Helenius, H-M., Masabane, P. (2016). *Universal social protection: The basic social grant for all older persons in Namibia.* Retrieved from http://www.social-protection.org/gimi/gess/RessourcePDF.action?ressource.ressourceId=53959

Wingate, V.R., Phinn, S.R., Kuhn, N. Bloemertz, L., & Dhanjal-Adams, K.L. (2016). Mapping decadal land cover changes in the woodlands of north eastern Namibia from 1975 to 2014 using the Landsat satellite archived data. *Remote Sensing, 8*(681), 1-20. doi:10.3390/rs8080681

Woltersdorf, L., Liehr, S., Scheidegger, R., & Döll, P. (2015). Small-scale water reuse for urban agriculture in Namibia: Modelling water flows and productivity. *Urban Water Journal, 12*(5), 414-429. http://dx.doi.org/10.1080/1573062X.2014.900691

Appendices

Appendix I. Market Survey Template

Market Name:			Date:		
	Brand Name	Retail Price (N$)	Unit weight (g, kg, L)	Origin	Notes
Staples					
Maize					
Maize Meal					
Rice					
Millet					
Millet Meal					
Sorghum Porridge					
Wheat Flour					
Sugar, white					
Legumes					
Beans					
Groundnuts					
Fruit					
Bananas					
Mango					
Guava					
Vegetables					
Spinach					
Carrots					
Potatoes					
Sweet Potatoes					
Other					
Cooking Oil					
Honey					
Seeds					
Pasta					

Appendix II. Farmer Questionnaire Template

University of Cologne –
Department of Anthropology
in partnership with
University of Namibia

FARMER SURVEY
AGRICULTURE IN OPUWO
FIELD RESEARCH
March 2016

Consent for use of data and information: [Yes / No]

A. Basic Data

1. ID #: _____
2. GPS coordinates: _____
3. Date: _____
4. Name of farmer: _____
5. Soil type: _____ Color: _____

B. Demographics

1. Age: _____
2. Gender: [Male / Female]
3. Ethnic Group / Origin: _____ *(Where is your family from?)*
4. Membership in Farmer's Co-op? [Yes / No]
    a. If yes, which one? _____

C. Location / Residency

1. Village/Location Name: _____
2. Seasonal or permanent location? _____ *(cattle post/ ohambo or onganda?)*
    a. If seasonal, how many months of the year are you staying here? _____
    b. If permanent, how long have you been farming this land? _____
3. Do you live at the farm site? [Yes / No]
    a. If not, where / how far away do you live? _____ km S / N / E / W
4. Are you full-time farmer? [Yes / No]
    a. If not, what is your other job? _____ Where? _____
5. Relationship to land:
    a. Own
    b. Lease for ____ years *(permission from traditional leaders)*
    c. Laborer
    d. Other_____

D. Farm Data

1. Total area of the garden: _____ hectares
2. How much area is under cultivation? _____
3. How many gardens do you have? _____
    a. If others, where are they? _____ Who cares for those gardens? _____
4. How many people eat from this garden: _____
    a. live in your household now? _____

b. including school children? _____

E. Crops

1. List your main crops:
    a.
    b.
    c.
    d.
    e.
2. How many hectares of your land are planted with maize? _____
3. What was the total yield of maize last year? _____ Kg
4. Do you produce for:
    a. Family consumption only
    b. Market sales only
    c. Both
    d. Exchange with other farmers
    e. All of the above
5. How much did you sell last year? _____Kg
    a. What was your income from sales last year? N$_____
6. How many months a year can you eat from the garden *(in a rainy year)*? _____
7. How much maize meal do you need to buy every month? _____
    a. How many months of the year do you have to buy maize meal? _____
8. Do you keep bees? [Yes / No]
    a. If yes, what method? _____
    b. How much honey did you produce in 2015? _____kg or L?

F. Production

1. When did you plant? _____
2. When will you harvest? _____
3. How do you prepare your land?
    a. Hand tools
    b. Tractor
    c. Animals
4. Where did you get your seed?
    a. Bought
    b. Saved
    c. From Co-op
    d. Exchanged with farmers
5. Do you follow Conservation Agriculture? [Yes / No]
    a. If so, what methods of CA:
        i. rip furrowing
        ii. ground cover
        iii. measured planting
        iv. water harvesting
        v. crop rotation
        vi. other _____
6. Do you irrigate? [Yes / No]
    a. Method: _____
    b. How much water do you use? _____ *(L per day, month, or year)*
7. Do you use fertilizer? [Yes / No]
    a. If so, what kind? _____ How much? _____
8. Do you use pesticides? [Yes / No]

    a. If so, what kind? _____ How much? _____
9. How do you harvest?
    a. Friends
    b. Family
    c. Hired labor
10. If you hire labor, how many people work on your farm? _____
11. Who works the land?
    a. Male / Female
    b. From Opuwo / from Angola / Other _____

G. Constraints

1. Do you have pest problems? [Yes / No]
    a. If so, which pests?
        i. Termites
        ii. Caterpillars
        iii. Crickets
        iv. Mice
        v. Birds
        vi. Cattle
        vii. Elephants
2. List the main difficulties / greatest needs. Place the biggest (or most difficult) first and others in descending order of importance.
    a.
    b.
    c.
    d.
    e.

Thank you for your time

Appendix III. Land Parcel Registration

In 1995 the Namibian parliament passed the Agricultural (Commercial) Land Reform Act, which was considered a milestone in post-independence policy. Some major points that the Act introduced are: legislation restricting acquisition of agricultural land by foreign nationals, granting the government the power to expropriate commercial land and reallocate it as communal land, and furthermore leasing it out in smaller parcels to disadvantaged Namibian farmers (Agricultural (Commercial) Land Reform Act of 1995).

A second major legislation was passed in 2002 with the Communal Land Reform Act. This Act focuses on administration of the rights of communal land by instituting land registration procedures and creating a framework for the allocation of land rights through the establishment of Communal Land Boards (Communal Land Reform Act of 2002).

On 29 March 2016, the research team sat with Mr. I.U. Tjipepa, Chief Development Planner at the Ministry of Land Reform (MoLR), to get an idea of how land reform policies are being implemented on the ground and what challenges the ministry faces in carrying out its responsibilities.

In regards to the Agricultural (Commercial) Land Reform Act of 1995, there has been little activity in Kunene due to the fact that there are simply no commercial farms in the area. The closest commercial farm is located approximately 200 km East of Opuwo, and thus lies outside the jurisdiction of the Kunene regional office.

The Communal Land Reform Act of 2002 carries with it more responsibility for the Kunene office, as most of the land in the surroundings falls under the category of communal land.

A large portion of the ministry's activities are related to land tenure application. Summarized here is the process of application for "Customary Land Tenure". First, a prospective land tenant must gain approval for their acquisition of a land parcel from their local recognized Traditional Authority. Upon approval, the applicant is provided a signed letter, which s/he submits as part of an application to the Land Board. This committee is composed of various ministries (e.g. Agriculture, Tourism & Environment) and other entities (e.g. conservancy agencies, farmers' unions), and investigates each application to assure that there is no conflict of existing tenancy and to assure that the land parcel is no larger than the legally permitted 20 hectares. Parcels larger than 20 ha may fall under the "Commercial Lease Hold" category and must be approved by the minister. At this point the MoLR must survey the parcel to estimate the land area and map parcel boundaries. The MoLR team walks the periphery of the field, recording its geographical coordinates using a Global Positioning System (GPS) device. These coordinates are subsequently loaded into a Geographic Information System (GIS), thus creating a

digitalized representation of the parcel which is stored in a database, along with other information such as land use, tenant name, and land area.

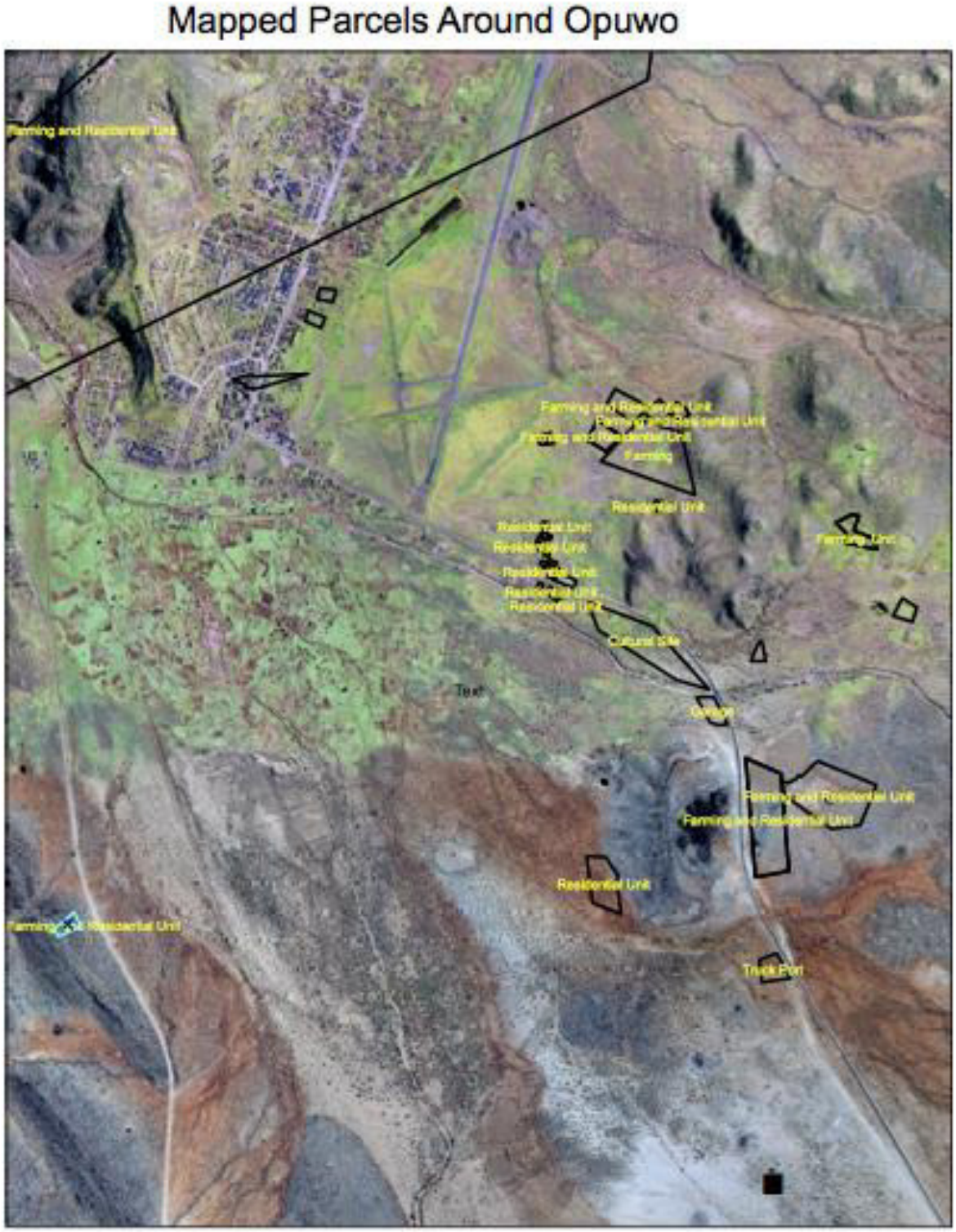
Customary land leases are granted for the duration of the holder's lifetime and can be passed down to the next generation. As Mr. Tjipepa explained, although each parcel is legally public land, this extensive lease period enables it to be managed as private land in practice. The application fee is N$ 25 and the registration fee is N$ 50. Once the application process is at its close, the application must be publicized for 7 days to allow for any public objection. If none, then the application is approved and the applicant receives a certificate for rights over the registered parcel of land.

Potential benefits of going through the land tenure application and registration process include long term security of a lease holding, as well as the eligibility to apply for financing from banks for investment capital for inputs such as fencing and tools. Despite these incentives, registration rates remain low. Most parcels in the area are unregistered. Mr. Karunga estimated less than 5% of land was registered as of 2016. Even if a parcel is registered, it is common practice to informally sub-lease portions of one's land to other farmers, thus negating any potential advantages of registration for those working the land.

One challenge for increasing land registration, especially in Kunene North, is the nomadic lifestyle of many citizens. People's priority is livestock, and thus there is a lack of motivation to spend the time and money registering their home and garden land. Another challenge is that of public trust. Citizens may misunderstand the reason for registering, worrying that it restricts their land use. Furthermore, many citizens may not even be aware of their potential access to land rights.

An interview with Mr. M.H. Karunga, GIS Officer with the Administrative & Outdoor Office at MoLR who is responsible for land parcel assessments, proffered further information on parcel digitalization. While the entire parcel registration process began in 2003, digitalization of parcels with the use of GPS and GIS tools did not start until 2010. The maps below are examples of the digitalized registered parcels. Each registered parcel is outlined as a geometric shape with a black border, and labelled according to the land use under which it is registered. The most common uses for customary land tenures are "Residential", "Farming" or mixed. This information is saved as a shape file and overlaid onto a satellite image obtained from a government survey in 2011.

Example 1: Digitalized Registered Parcels



Credit: M.H. Karunga, GIS Officer with the Administrative & Outdoor Office at Ministry of Land Reform

Example 2: Digitalized Registered Parcels

Credit: M.H. Karunga, GIS Officer with the Administrative & Outdoor Office at Ministry of Land Reform

Culture and Environment in Africa Series
Edited by the Cologne African Studies Centre

Issue 1 **Goodman Gwasira 2011**
A Rare Combination of Engravings and Paintings in the Dome Gorge, Daureb/Brandberg. A potential core element for World Heritage Status.

Issue 2 **Eric Mutisya Kioko 2012**
Poverty and Livelihood Strategies at Lake Naivasha, Kenya. A case study of Kasarani Village.

Issue 3 **Willis Okumu 2013**
Trans-local Peace Building among Pastoralist Communities in Kenya. The Case of Laikipi Peace Caravan

Issue 4 **Innocent Mwaka 2014**
Bee-keeping and honey production as alternative livelihood strategies among the Pokot of Baringo County, Kenya

Issue 5 **Florian Chisawani Silangwa 2014**
Migration and demographic changes. Its implications on land transformation and changing socio-economic development in the Lake Eyasi Basin in Karatu District, Tanzania

Issue 6 **Leonardo Lembcke 2015**
Socio-Ecological Change and Migration in South-East Lake Naivasha, Kenya

Issue 7 **Elsemi Olwage 2015**
"Growing together": the politics of knowing and creating an urban commons in Cape Town, South Africa

Issue 8 **Jonathan H.M. Kempen 2016**
"Sharing is over!" – A Case Study on Sharing Norms in the Namibian Resettlement Projects of Skoonheid and Drimiopsis

Issue 9 **Joel Kigenyi 2016**
Coping with resource extinction: the case of medicinal plants in Kawete village, Iganga district, Uganda

Issue 10 **Katrin Sowa 2017**
Street-Level Bureaucrats and Passport Networking: Practices of Immigration Law Enforcement in Northern Uganda

Issue 11 **Tanyaradzwa Edith Whande 2018**
Energy Sources, Access and Women's Livelihood Strategies:
A Case Study of Micro- Hydroelectricity Access in Chipendeke Village, Zimbabwe

Issue 12 **Adelina Matinca 2018**
Human-Wildlife Conflict in Northeastern Namibia: CITES, Elephant Conservation and Local Livelihoods

Issue 13 **Emily Mika Thuening 2018**
Causes of Expansion of Urban and Peri-Urban Crop Cultivation in Northwest Namibia